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JOURNAL

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THE FRANKLIN INSTITUTE,

OF THE

State of Pennsylvania,

FOR THE

PROMOTION OF THE MECHANIC ARTS.

DEVOTED TO

MECHANICAL AND PHYSICAL SCIENCE, CIVIL ENGINEERING, THE ARTS AND MANUFACTURES, AND THE RECORDING OF AMERICAN AND OTHER PATENTED INVENTIONS.

EDITED BY
JOHN F. FRAZER,
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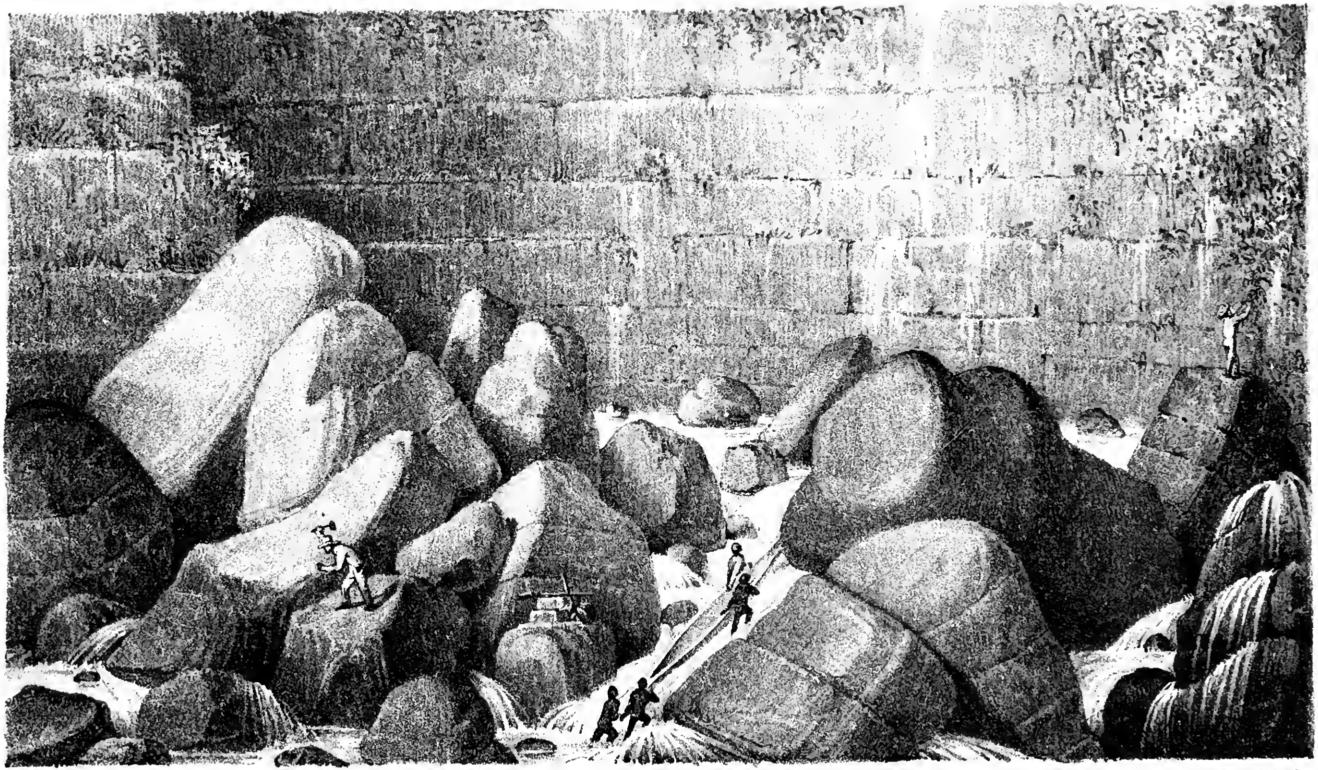

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VIEW ON THE PATÓ, NEAR ITS SOURCE.

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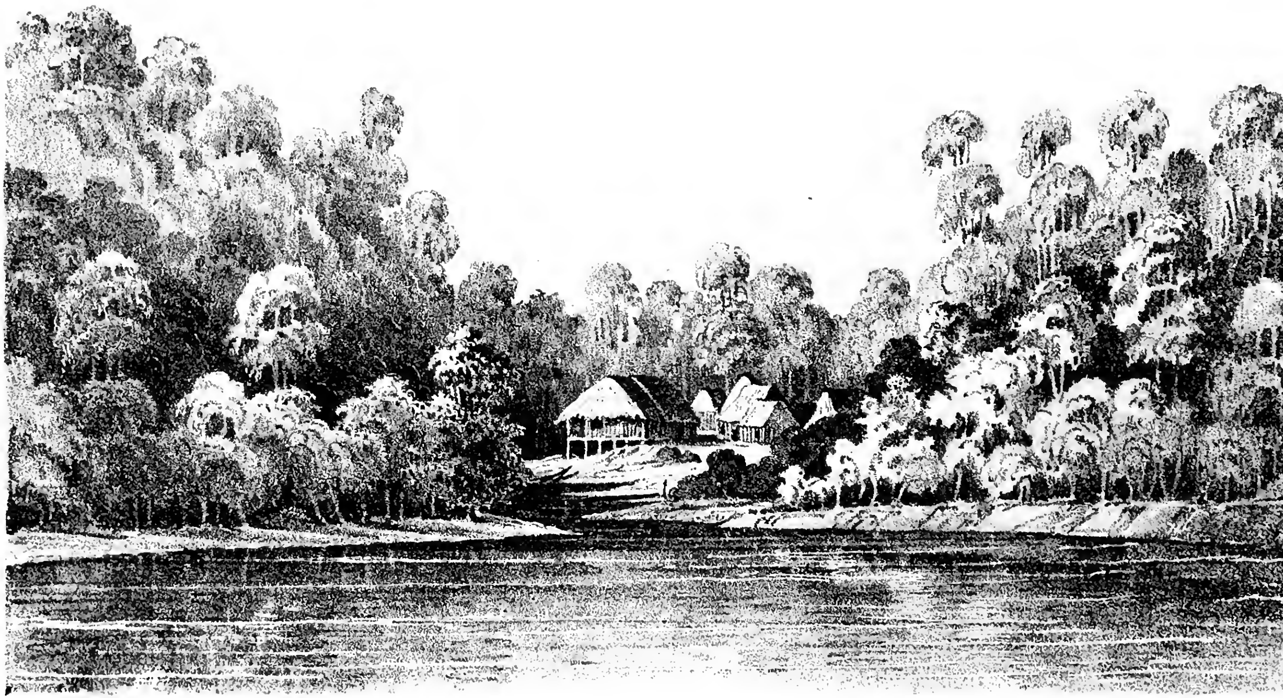

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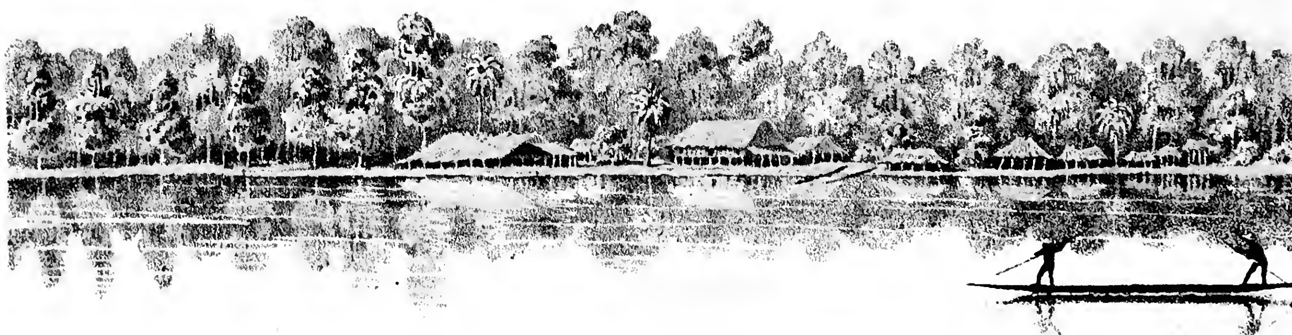

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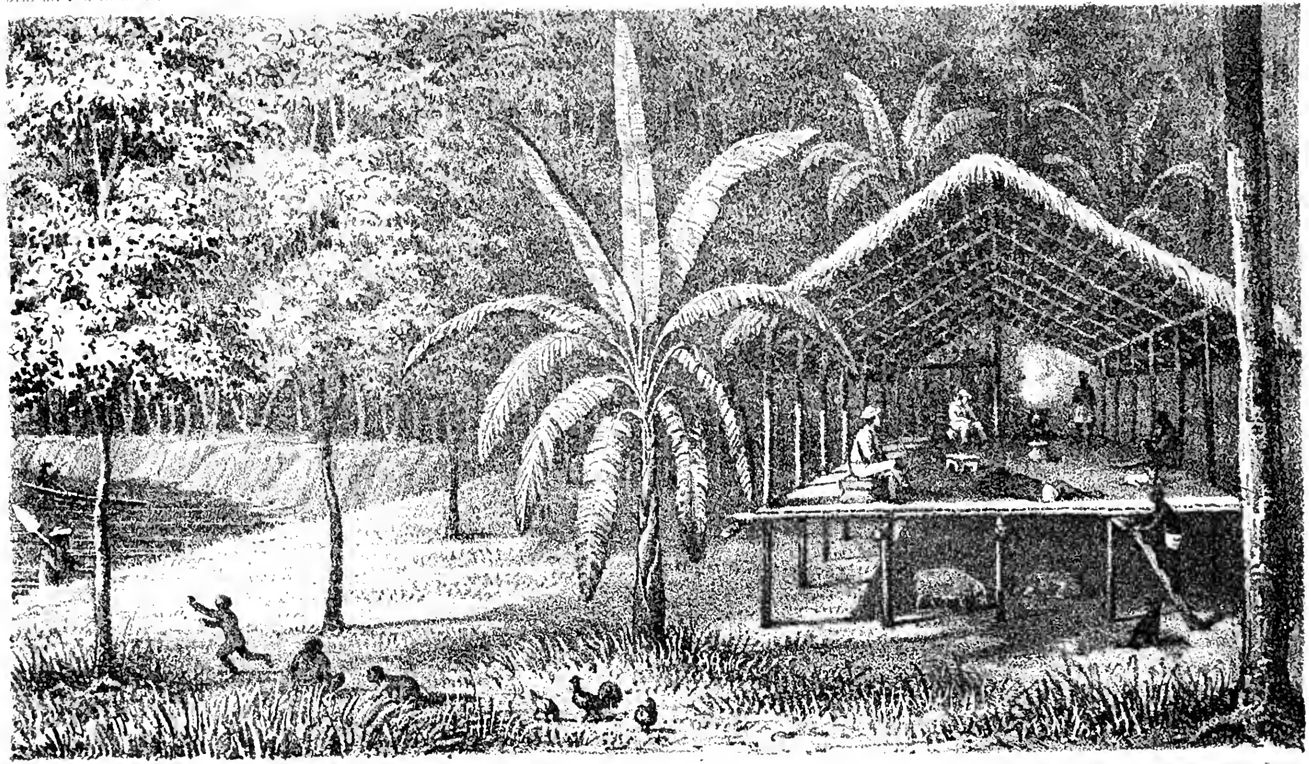

INDIAN HUT ON THE PEPE.

JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS.

JULY, 1854.

CIVIL ENGINEERING.

For the Journal of the Franklin Institute.

Rough Notes of an Exploration for an Inter-oceanic Canal Route by way of the Rivers Atrato and San Juan, in New Granada, South America. By John C. Trautwine, Civ. Eng., Philad.

Continued from p. 373.*

The River Pato. The Pató is but an insignificant stream. Like the Napipí, it is very circuitous; and we found its channel to be much encumbered by trees and logs from its mouth to its sources.

I did not take the bearings of its sinuosities; but merely estimated its length by repeated observations of our rate of motion. According to this process of computation, we ascended it for 34 miles, although in a straight line, the distance would certainly not have exceeded about one-half that amount.

At three miles above its mouth, its width varies from 30 to 50 yards, with centre depths from five to eight feet at the time of our visit. At its lowest stages, the depth here occasionally becomes so reduced for days at a time, as barely to allow a free passage for large ranchadas.† Along

* Errata in last Number, p. 365, last line, and p. 366, fifteenth line from top, for *transition*, read tertiary.

† Wherever remarks of this kind are made, the reader will understand that they are in accordance with the representations of my boatmen, or of the natives living on the banks of the streams. The former were well acquainted with the Pató, and other streams which I explored.

here we noticed the first bamboos we had yet met with. We also passed a bluff of red and gray clay and gravel, 30 feet high.

At six miles from its mouth, the Pató receives a branch called the Chiraguandó, coming from the south. At this particular point we found the width reduced to about eight yards by obstructions caused by a formation of hard cemented gravel; while the depth was increased to ten or twelve feet.

About here, the banks begin to be considerably higher than at the mouth, being generally from six to nine feet above the surface of the water, as we found it; and in some spots, where the stream washes hillocks of stiff diluvial clay and gravel, the ground is elevated as much as from 15 to 30 feet. In this vicinity we also noticed the freshet marks on the trees, as high as 12 feet above the water, showing that the ordinary banks must at times be overflowed to a depth of several feet.

At about 9, as well as at 11 miles above its mouth, the stream cuts through low ranges of diluvial hills of from 30 to 100 feet in height, and having a general direction nearly north and south. Along here, the average width is about 25 or 30 yards; the current just two miles per hour in the swiftest parts of the cross-section; although to the eye it appeared much greater, in consequence of the splashing over fallen trees, logs, &c. Above the nine mile point, the firm diluvial banks are frequently quite perpendicular to a height of from 20 to 60 feet. These vertical faces, however, are sometimes clothed with vegetation, such as ferns, the musa, &c. In many cases they appeared to be *shingled*, as it were, with the musa leaves, presenting an odd and interesting sight.

The musa leaf furnishes a very convenient as well as effective shelter from the sun and rain. It generally attains a length of about five feet, but we found some on the Pató as much as seven feet long. It resembles somewhat the plantain leaf.

There are two or three varieties. That commonly used is called the "hoja blanca," or "white leaf." One side is smooth, but the other is covered with a white fuzz, which sheds off rain perfectly. When the canoe has a toldo, the top is covered with two or three layers of these leaves; and when destitute of that luxury, a few of them are laid on top of the baggage and held down by stones. Sometimes our boatmen would insert one end of a leaf between the backs of their heads and their hats, letting the leaf fall down their naked backs as a protection from the chilly sensation produced by the falling rain-drops.

Early in the afternoon, there was every indication of a very heavy rain, and we stopped for the day at an Indian hut, some 15 miles above the mouth of the Pató. At this distance, the width of the stream diminishes to an average of from 50 to 75 feet, with an ordinary depth ranging from 4 to 6 feet in the channel-way.

The proprietor of the house, with his family, consisting of wife and child, were absent when we stopped; but we were readily admitted by his father-in-law, whom we found at home. The others, however, arrived about an hour afterwards in a canoe, in the midst of the rain. In passing from the canoe to the bank, the woman had to walk a floating log, a few yards long, and in order to have the free use of her arms to balance herself, she pitched the child (about eighteen months old) upon

her back, to which it clung, as the young monkeys do, apparently by instinct, exhibiting as little apprehension as herself, as she with difficulty retained her footing on the rolling log. All the family were destitute of clothing, except that article of apparel which, with us, pertains exclusively to infants.

The hut was about eighteen feet square, and raised several feet above the ground on posts. It consisted merely of floor and roof, without sides, or any protection from the wind or slanting rains. The Indians appear to be much less provident in this respect than the blacks; for the houses of the latter always have sides, while those of the former are generally without them. The floor was composed of rudely split strips of the palm laid loosely side by side; and the roof, of palm leaves.

For furniture, they had two earthen pots, a few calabashes, a machete or long knife, a pebble for sharpening it, an extremely rude axe, three or four twig baskets of their own manufacture, a small piece of home-made net, a blow-gun, and a bow and arrows; while their entire wardrobe consisted of half a dozen small pieces of rag strung up on the posts of the hut. Their bedding comprised only two wide strips of the inner bark of the damagua tree, and a few short, flattened logs for pillows.

When the Doctor and I had finished our supper of sardines, biscuit, and claret, we presented our hostess with the box and bottle. These splendid articles were handed around, and greatly admired by the family. A few minutes after receiving them, the woman went out in the rain, and soon returned holding a live chicken by the wing. This she offered to me as an evidence of her gratitude for the valuable present she had received, and appeared disappointed at my refusing to accept it, until I proposed that she should keep it for me until our return.

On the opposite side of the stream, they had a small patch of plantains. This fruit, together with the results of their fishing and hunting, were their chief dependence for food. A few pigs and chickens are generally kept by the Indians, but these are reserved for special occasions of festivity, or scarcity of other means of subsistence.

Early in the evening the Doctor and I hung up our hammocks, and turned in. Our boatmen enveloped themselves in their blankets, and stretched themselves out on the floor, each with a log pillow under his head; while our host and his family lay down huddled together on their strips of damagua bark, without any covering whatever. The rain was pouring in torrents, and the wind sent it flying through the hut, so that we were all very essentially ducked. The lightning was performing in brilliant style, and allowed me to see the exposed condition of the mother and child, upon whom, however, the rain appeared to fall as unheeded as upon the palm strips upon which they lay. Still I could not endure the sight. One of my blankets was folded up under my head as a pillow; and the other at my feet, as a reserve in case of feeling too cold before morning, as is generally the case. Converting one of them into a ball, I aimed at the broadest part of the lady's body, and fired; it took effect, for she bounced up, directing her vision towards the monster (not me, but the blanket,) that had so rudely disturbed her slumbers. After enjoying her bewilderment for a moment, I explained the phenomenon, and endeavored to prevail on her to use the blanket to cover herself and

child. She laughed good naturedly, and having quietly hung the blanket to a post of the hut, lay down again: while I, disappointed in the result of my benevolent intentions, settled myself once more into my drenched hammock, inwardly resolved nevermore to be so excessively polite to an Indian woman; a resolution the more easily kept, as they are stupendously homely.

Next morning our boatmen expatiated on the pecuniary value of the blanket, and on my generosity in giving it away. The circumstance had evidently produced a favorable impression, and the entreaties that I should take the chicken with me were renewed. It was declined, however, to the evident chagrin of the boatmen, who knew better than I that we should soon be glad to have it.

With some difficulty a few dimes were forced upon our host at starting. He inquired my name, and finding it was John or Juan, he was much gratified, inasmuch as it was also his own, or as he gave me it more in extenso, Juan de Dios (John of God).

A few hundred yards above the hut, we passed the mouth of the branch Pavarandó. At some 2 or 3 miles above this stream the ground becomes more generally elevated, and presents many isolated conical hills; while the river banks are at times bluffs of from 30 to full 100 feet in height. These in some cases descend to the stream by easy slopes, and in others form perpendicular faces of indurated grey and brown clay, and sand; generally, however, the banks for 15 miles above the Pavarandó are of mud and fine sand, interlaid with beds of dead leaves, and branches. Some pieces of the hardened clay on being split exposed black impressions of leaves; and at 8 miles above the Pavarandó we found two or three rolled pieces of compact black lignite. At this latter point, the average width of the stream is about 50 feet; and its depth, swelled by the hard rain of the previous night, about 5 feet in mid-channel; ordinarily, however, it is but 2 or 3 feet.

At 12 miles above the Pavarandó, or 27 miles from the Quíto, the Pató again divides into two apparently equal branches. The men, however, told me that the northern one was merely a long wash, or quebrada. From this point, up to the head of the stream, boatmen have frequently to drag their ranchadas for nearly the whole distance. We, however, in consequence of the rain, still had 2 or 3 feet of water in the channel, with a current of full two miles per hour.

We here saw freshet marks as high as 16 feet above the water surface. For some miles back the stream was frequently so choaked up with fallen trees that we were compelled to get out, unload, and force the boat under them, or over them, as the case might be.

Early in the afternoon, after having traveled about 14 miles, or 29 miles in all from the Quíto, we came to an unoccupied, temporary, half ruined shelter of leaves, placed on forked sticks, and about six feet high at the highest part. Our patron advised us that as this was the last shelter we should meet with before crossing the partition ridge, and reaching the Baudó, we had better stop here for the day, and thus have the whole of to-morrow for crossing, and examining the country; otherwise, as the navigation was becoming every hour more slow and fatiguing, we could go on a mile or two farther, and construct a shelter of

branches ourselves. We preferred the former alternative, although our domicile offered but few attractions. It had no sides,—no floor except the wet ground,—nor were the sticks which supported the roof sufficiently high or strong to allow us to swing our hammocks. Indeed, the only favorable trait in its construction was the facility which the roof offered for the contemplation of the starry firmament, on those rare occasions on which it is visible. But "where there is a will, there is a way," so we made a dry floor of branches, and cut a few musa leaves to cover ourselves in case it should rain during the night. Then we built a fire, put on some plantains to roast for supper, and took a bath. A stroll was of course out of the question, here, as almost everywhere else in this region, on account of the mud, and dense wild vegetation. We were therefore compelled to resort for occupation to our segars, and surmises as to what to-morrow would bring forth. Soon after dark our men talked themselves to sleep with appropriate discourses about tigers and snakes; but the novelty of our situation, and the exciting anticipations of to-morrow, in connexion with the pattering of the rain, and the flashes of lightning, kept the Doctor and myself awake until midnight. It rained all night, but not heavily; so that by shifting our positions occasionally, we managed by help of our musa leaves to keep ourselves tolerably dry. Fortunately we had no musquitos, and but few sand-flies to trouble us. By early dawn we had made and drunk our coffee, and were prepared to start. By our patron's advice we took down our toldo, and left it behind, as the increasing number of fallen trees would render it impossible to preserve it as we forced the boat under them.

We were now but 5 miles from the Cabacéra, or place of disembarkation, from which point we were to cross the dividing ridge between the waters of the Atlantic and Pacific, on foot.

In sight from our humble shelter of the previous night, and towering above the wet, rank, vegetation around us, two or three isolated conical hills, some 300 or 400 feet in height, reared themselves directly in our path, giving rise to unpleasant forebodings. Their slopes, although very steep, were densely covered with trees and undergrowth.

At $1\frac{1}{2}$ miles from our starting point we passed banks of soft gray argillaceous sandstone, containing shells and a little lignite. Large boulders of this rock now begin to obstruct the stream in many places; and at certain points its nearly horizontal strata constitute the entire bed. See Plate I.

At many points we barely cleared the rocks on each side by an inch or two; and the water flowed through channels which almost appeared to be artificially excavated in the solid stone. We had sometimes to unload the ranchada, and assist the bogas to lift her up little cascades; at other times we would walk in the stream, and help buoy her up in shallow places, or press her down into the water to pass under large fallen trees.

At $1\frac{1}{2}$ miles below the Cabacéra the stream divides into two nearly equal branches. The one to our left is called the Pató; and that to our right, which we followed, the Pié. The last two miles were by no means destitute of the picturesque on a moderate scale. Numerous little rain cascades, some of them 100 feet in height, leaped headlong down the

perpendicular banks, scattering their spray over the ferns and festooned vines which clung tenaciously to a scanty foothold among the rocks. At other times they coursed wildly down the steep ravines of the high hill bluffs, and mingling their waters with those of the pretty, transparent, little Pató, gamboled frolicksomely among the boulders of indurated clay, and soft grey sandstone, which in vain endeavored to arrest their progress; or demurely pursued their penitential way though level pools created by the fallen trees.

I judged the descent of the stream for the last mile to be between 50 and 60 feet, as nearly as I could estimate by an occasional use of my hand-level. Within the last half of its length, the Pató has a great number of small tributaries: we counted full 30 of them.

We were about four hours in traveling the last 5 miles to the Cabacéra, at which point we arrived at 10 A. M. Here the stream again subdivides into two rivulets, in neither of which would our ranchadá float empty.

As there was no hut here, we made a fire, and cooked our breakfast, by the side of the stream.

This over, we dragged the boat to a point sufficiently high to secure her against floods during our absence; and having concealed our heavy iron cooking pot in the woods, the crew took our baggage on their backs, supporting it by a strap around their foreheads; and precisely at noon, our unpretending expedition took up its line of march on foot for the waters of the Pacific. The Doctor, with his fowling-piece in one hand, and a roasted plantain in the other, constituted the military;—the three bogas, —the baggage train; and I, with a compass, tape-line, level, and bottle of schnaps, filled the scientific department.

For the first few hundred yards our path occupied the bed of the stream; then suddenly turning to the west, we began the ascent of the ridge of partition. It required but a glance to convince us that Father Ochoa's 18 feet must be remarkably long ones, (expanded perhaps by a tropical climate;) and I sullenly drew from my pocket that invaluable instrument for explorers, the hand-level of Dr. Locke of Cincinnati.

With this instrument I at once began to level up the steep ascent, and continued to do so until we had attained a height of 500 feet. At this elevation I stopped levelling, but we rose I judged *at least* 200 feet more before we reached the summit. From the summit the descent towards the west was very abrupt, so much so that we sometimes descended 50 feet vertically in a horizontal distance of 25 feet, letting ourselves down almost perpendicular precipices of rock by aid of the vines and bushes that grew on them. A dog who accompanied us would stand howling piteously at the top before making his plunge, and then pitch down head over heels. The actual time consumed in walking across this ridge from the Pató to within a few hundred yards of the River Baudó, was an hour and three-quarters, independently of rests. Our rate of progress being very slow, on account not only of the steepness of the path, but the mud, the Doctor and myself assumed the distance at about three miles. For near one-third of this, the route presented a somewhat novel feature to both of us, and one which I hope not to encounter again. The novelty consisted in a narrow path, varying in breadth from 2 to 8 feet; and bounded on both sides by nearly vertical descents of from 50 to full 200 feet.

I am very subject to a distressing vertigo when looking down great depths, and can compare my sensations on this occasion to nothing but a frightful night-mare. The tendency to throw myself down the precipice was almost irresistible, and only counteracted by crawling over the worst places on all fours, with my face close to the ground.

Dr. Halsted, on seeing to what extent I suffered, advised a retreat, to which of course I could not assent. The men offered to carry me on their backs, which is a common mode of transporting travelers in this part of the world ; but neither did this species of locomotion meet my approbation. I told one of them however to walk but a single step in advance as I crawled along the worst spots, so that if by chance I should lift my eyes from the ground they should rest on him instead of the descent before me. At one point however even this precaution nearly failed. For some few yards the path was scarcely two feet in width, and I could not avoid seeing down the abyss if I kept my eyes open. I felt as if suspended by a hair at an immense height, and was compelled to close my eyes. Dr. Halsted holding on by a sapling, leaned over, and reported no soundings at less than 200 feet.

It required a desperate effort on my part to pass this spot, and nothing but the fear of disgrace induced me to make it. The Doctor and our bogas were not in the least affected; indeed, the gratification, coolness, and carelessness of the former appeared to vary inversely as the width of the path; while the latter, trudging along unconcernedly with their loads, were entirely at a loss to comprehend the cause of my undignified manœuvres.

The feature which most astonished us was, that a great portion of this abominable route, instead of rock, consists of clay and gravel, supporting a vegetation not only of grass and shrubs, but of full sized trees. The only cause I can assign for the permanence of those high steep slopes, of such materials, is the absence of frost.

The rock which showed itself at various points, both of the ascent and descent of the ridge, as well as at its summit, is the soft grey tertiary sandstone with fossil shells, before alluded to. Among the broken boulders near the head of the Pató we saw many portions of large fossil conch shells, and selected several specimens to bring home, but as we did not return by this route, they were left behind.

Throughout the entire exploration, we had, in compliance with the request of friends at home, maintained a diligent, but unavailing search for land and fresh-water shells. Perhaps the fact of the frequent inundations is unfavorable to their development ; as may also be the muddy condition of the water in times of flood.

In crossing from the Pató to the Baudó, we did not see a single bird, or wild animal of any kind ; and but two or three small birds along the upper part of the Pató itself.

At the western foot of the ridge we found a large hut consisting only of floor and roof; raised several feet above the ground as usual, to avoid the floods of the Baudó, which flows within a few hundred yards of it. This hut had no regular tenant, but had been constructed for the accommodation of persons traveling this route. We found it empty; and at once took possession for the day. As soon as we arrived, I sat the men to work to clear away a few trees for observing the latitude in case the

night should be clear, as it promised to be. Having only their machetes, however, this proved to be slow work. The largest of the trees in falling came very near crushing the hut to pieces; but worst of all, just as we had cleared a space sufficient for our purpose, the heavens became suddenly overcast with clouds, and so continued, with occasional showers all night.

By degrees, as evening closed in, other travelers made their appearance at our hut, in the shape of natives who had ascended the Baudó with canoe-loads of plantains, which they were taking to Quibdó for sale. They carry all their produce on their backs over the route we had just passed; and when occasionally they have larger cargoes than they can transport at one load, they make the trip two or three times in the same day. Yet the entire value of the load carried by each one probably averages but a dollar in Quibdó, after having been transported 50 or 75 miles. As there is no regular system of canoes on the opposite sides of the ridge, in the event of finding no boat on the side opposite that from which they came, they construct small rafts of branches tied together by vines, and thus drop down the stream with their loads.

They and we were of mutual assistance to each other; for as I had determined not to recross the ridge by the same villainous route, there was a prospect that we might have to build a raft for navigating the Baudó, until we should chance upon some other pathway back. So we told them they might have our large boat, on condition of delivering it safe at Quibdó; and they in return put us in the way of procuring one sufficient for our purposes.

When we retired for the night, we formed an interesting group, consisting of 2 whites, 18 naked negroes and Indians, (among them one woman,) and 2 dogs, all stretched out on the floor of a hut 20 feet square.

The dogs probably enjoyed the night less than any of us; for the bipeds soon found that when a dog lay down near him, he attracted more than his due share of sand-flies; a very natural consequence of which was that at intervals of about every half hour during the night a dog was pitched or kicked headlong from the floor down to the ground. In appreciation of the compliment he would entertain us with a short serenade, and then come back to try his luck with some other sleeper; but always with the same result.

Before we left Quibdó, Governor Conto had considerately prepared for us in his official capacity, a written document, enjoining upon those to whom we might have occasion to present it, a due consideration for our necessities, and the conferment of such aid as we might reasonably require of them. He regarded the object of our mission as one that might eventually contribute in some measure to advance the prosperity of New Granada, and neglected no means that would conduce to the furtherance of our examinations.

Had it not been for this paper, we should probably have been compelled to resort to a raft; but by its aid, backed by a liberal compensation, we next morning obtained the ranchada, of which our friends of the hut had spoken the previous night. We of course engaged to send it back when we should have done with it. A quarter of an hour's stroll through the muddy woods brought us from the hut to the Baudó, where

lay the ranchada. This was but two feet wide, and one foot deep; and with our load drew full 8 inches, leaving but 4 inches above water. We soon discovered to our great disgust that she was badly addicted to rocking and leaking; which qualities, combined with the absence of all shelter from the sun and rain, rendered her anything but a desirable craft for a voyage of nearly 100 miles. But we had no alternative. To our great surprise, we found this stream to be (instead of the insignificent creek which we had expected) a really fine navigable river even at the point at which we struck it; and at which we had been led by the map to suppose we should encounter its very sources. How far it reaches above this point we could not ascertain; but I have, in my map, (Plate XII, vol. xxvii,) given it the least extent that I considered at all warrantable by its magnitude at our place of embarkation.

Here we made a careful measurement of the width, and found it to be 210 feet; and the depth nearly all the way across 14 feet. Yet we were told that the water was rather below than above its ordinary stages; and so indeed the line of no vegetation, which was above the surface, showed it to be. The current was scarcely two miles per hour in the swiftest part of the cross-section. The banks at the same time varied in height from 5 to 10 feet above water, and consisted of mud so soft that I had to use a pushing pole laid flat on it, to prevent me from sinking into it as I measured a base with my tape-line.

We were told, however, that the river occasionally falls so low as to have here a channel depth of but 5 or 6 feet for some days at a time; while, on the other hand, in high floods, the depth increases to full 25 feet, overflowing all its banks. Back from the river, on both sides, the ground is soft and muddy, but the levees are by no means so marked as in the Atrato. As we descended, the ground gradually became more swampy.

From what I had heard at Quibdó of the limited depth of the San Juan at San Pablo, and for a considerable distance below it, I now felt pretty confident that the Baudó was in itself the better river of the two, for the purpose of an inter-oceanic Canal, provided we should be able to find a low pass through the partition ridge, for uniting it with the Quitó. Under this conviction, I at once determined to examine it carefully to its mouth; and immediately commenced taking its bearings, distances, and soundings.

The first two features are shown on the map (Plate XII, vol. xxvii,) which has been protracted from my notes: and our subsequent exploration of the river for 85 miles to its mouth, proved that I was not mistaken as to its general character.

In no cross-section below the place of embarkation, (except near the mouth,) did I find a less maximum depth than 14 feet for the same stage of the river, even in wide places. The width, however, is by no means so variable as that of the upper portions of the Atrato, which circumstance tends to a greater uniformity of depth. Still there are certain comparatively contracted spots, at which the yielding nature of the river bed insures a proportionate increase of depth.

Thus, at about 17 miles below our starting point, at an Indian hut, where we stopped for the day, we found the narrowest part of the river we had yet met with. Here the width was contracted to less than 150 feet, by a

bluff of the soft grey tertiary sandstone, or, more properly speaking, indurated sandy clay, with shells, before spoken of; and the depth on the concave side of the bend was 33 feet, diminishing to 9 near the convex bank. But thus far the river had preserved a remarkable uniformity, not only of width and depth, but of the height of its banks. Even here we found the most rapid part of the current to be but full 2 miles per hour.

To-day we passed a few alligators; also some sunken trees, the removal of which would be necessary should steamboats be introduced on the river. We also saw a few of that diminutive species of monkey called the titi; and shot what is here called a wild turkey. Being no ornithologist, I can venture no farther than to say, that, although *not* a wild turkey, it sufficed to make a capital supper for us all.

We stopped early in the afternoon in consequence of a very heavy rain, to which we were fully exposed, inasmuch as our boat had no toldo. Some musa leaves laid on our baggage, kept it dry; and by constant bailing with a calabash, we kept the boat afloat for an hour after the rain began, until we reached the hut, which was only the fifth one we had yet passed on the river. The posts on which the floors were raised were usually from 4 to 6 feet above the ground. The small number of huts was explained by our bogas as a consequence not only of the want of elevated spots on which to erect them, but of the swarms of sand flies and other insects which infest the low marshy margin of the stream. Of the justice of,this argument, we had ample demonstration whenever we got among the bushes to measure base lines. On such occasions we generally shipped a full load of them, and always found it hard work to get entirely rid of them for some time after starting again.

The hut was open on all sides, and was occupied by quite a large family of Indians. One of the men we noticed was taller than any Indian we had yet seen; but on measuring him he resulted in but 5 feet 7 inches. The dress of both sexes was the fashionable one of a solitary rag.

It appeared that they had recently been successful in their hunting, for the remains of several wild hogs and some large fish were suspended from pieces of vine in all directions across the hut, diffusing an odor very unlike those of Araby.

On a layer of clay placed on the palm-strip floor, a fire was burning, apparently for preserving the meat. The smoke from it filled the hut, notwithstanding the want of sides; and with the smell arising from some dozen hogs which resided a few feet below the open floor, forcibly reminded us of the cabin of our river boat on the Atrato.

Here, as at every other stopping place since leaving Quibdó, the cloudiness of the night prevented us from observing the latitude. The rain tonight raised the river four feet. The flood marks here were 12 feet above the water of last night, or 8 feet above that of this morning. Our host told us that the *ordinary* stage of the river might be considered as comprised between these two limits.

The next day we descended the river 21 miles further, or about 38 miles in all from our place of embarkation upon it. Thus far the river retains its average width of but a little more than 200 feet; but occasionally widens to 300 for short distances. The latter was the width at our second stopping place. On taking soundings here, I was surprised at its

great depth, inasmuch as a shallow channel was naturally to be expected at so broad a point. From the banks the soundings increased to about 45 feet at the distance of 100 feet from each shore, while the inner 100 feet gradually increased from 45 feet at the edges up to 51 feet in the centre.

Yet at a point but a mile below, where the width was the same, we found a maximum depth of but 21 feet, and the transverse area of the cross-section but one-half that of the upper one. On reflection, I was led to ascribe the great depth at the former point to the action of the *remolinos*. These are currents near the banks, which run (in many instances rapidly) in a direction contrary to the downward one of the central portions of the river. These upward currents are very common throughout all the rivers of New Granada that I have seen, as, for instance, the Chagres, the Magdalena, the Atrato, the Baudó, the San Juan, &c. The boatmen always avail themselves of them, and it is not uncommon, in some of them, to see, at the same time, boats dropping rapidly down the river by the central stream, and others passing as rapidly up it, with no other propelling power than the remolinos of the side channels.

Some of the remolinos of the Baudó struck me as being by far the most remarkable I had ever seen; and in the deep section to which I have first alluded, they were beautifully illustrated. The two upward currents occupied full two-thirds of the entire width, and appeared nearly to equal the central one in velocity.

I conceive that we may regard these remolinos as virtually reducing the width of the channel-way of the descending stream, and thus tending to induce a corresponding increase of depth. This suggestion is offered with due diffidence, inasmuch as I am not aware that this deepening effect of the remolinos has ever before been observed, or at least ascribed to that cause.

The various tributaries which enter the Baudó, appear to affect its width but little, until we descend a considerable distance below the town of Baudó. Their action operates chiefly in increasing its depth. Although it rained hard for several hours last night, the river fell 4 inches.

(To be Continued.)

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*Experiments with Robbins' Self-acting Brakes for Railway Carriages.**

An important incident in railway history, and one in which the public safety is intimately interested, took place on Wednesday last (the 11th inst.) when an experimental run was made from Waterloo station to Windsor, for the purpose of testing the efficiency of Major Robbins' invention for applying self-acting brakes to railway carriages. The train consisted of engine and tender, with a brake van and 16 carriages, only eight of which, however, were furnished with this new contrivance. The object of thus lengthening the train by these eight carriages unfurnished with the apparatus was to put to a severe test the facility of backing with the self-acting brake—a part of the experiment about which some slight doubt had existed, but which proved, even under disadvantageous

* From Herapath's Journal, No. 762.

circumstances, triumphantly successful. There were present several engineers and men of science connected with the leading railways of the country to witness this important trial. The first stoppage made was at the Wandsworth station, which, being near the junction, the speed attained did not exceed 20 miles an hour; proceeding at which rate the train was brought to a stand, without perceptible abruptness, in an incredibly short distance. Between this station and Putney, a speed was reached of 35 miles an hour, when a second experiment stopped the train within a distance of 250 yards. It is important to remark that an ordinary train proceeding at this rate could not be stopped in less than 800 yards. The next experiment was tried at a speed of 40 miles an hour, in which the stoppage was effected in 450 yards, and in about 50 seconds of time. On returning from Windsor, fog signals were placed upon the line in situations unknown, till they announced themselves by their explosion, to any person on the train. On passing over the first, the train was advancing at a speed of 35 miles per hour. The steam was instantly shut off, which process alone immediately brings this brake into operation, and the train was brought to a stand at 460 yards from the point at which the signal exploded. Had all the carriages been furnished with these brakes, and the experiment thus disembarrassed of the additional *momentum* caused by the eight unfurnished, there can be no doubt that the stoppages would have been effected in a much shorter time and distance. On the return of the train to Waterloo, it was evident that the trial had proved highly satisfactory. The great difficulty in connexion with self-acting brakes has always been, that of so arranging the apparatus as to allow the engine driver to back his train as occasion might require. The difficulty, it would appear, has been entirely overcome by the invention of Major Robbins, the train having been repeatedly shunted in the course of the experiments for the purpose of testing its capabilities in this respect. While the train was stopping at Windsor, Prince Albert, accompanied by a party from the Castle, visited the station, for the purpose of inspecting the contrivance. Major Robbins had the honor of being presented to his Royal Highness, and of explaining to him the principles and application of his apparatus, which were evidently apprehended and appreciated by the Prince with characteristic readiness.—*The Times.*

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*Experiments with Self-acting Railway Signals.**

The self-acting signals are being adopted on French lines. *Galignani* speaks of an experiment made in presence of a commission on the Bordeaux and Test railway. The invention consists of mechanisms placed on the external edge of the rails, and united together by an electrical wire, which gives the signal of the arrival of the train on a curve or in a tunnel. The apparatus may be established in such a manner as to act not only at a distance of 700 metres, but even 3000 metres. The passage of a train on entering on a curve or on approaching a tunnel causes, by the pressure of the springs of the apparatus, the explosion of petards, which are heard at a great distance, and at same moment moves a colored disk, which gives the signal to the approaching train to stop.

* From the London Builder, No. 572.

AMERICAN PATENTS.

List of American Patents which issued from May 2d to May 23d, 1854, (*inclusive.*) *with Exemplifications by* Charles M. Keller, *late Chief Examiner of Patents in the U. S. Patent Office.*

MAY 2.

1. For an *Improvement in Sewing Machines;* Isaac M. Singer, City of New York.

Claim.—"What I claim is, forming seams for stitching and sewing with two threads, the first of which is carried through the cloth at each stitch, and interlaced with the second by forming a loop with the second on one side of a loop formed with the first, and then forming a second loop with the second thread, which is drawn through the loop formed with the first thread, and through the first loop formed with the second thread, as described. Also, the needle and looper, in combination with the instrument, or its equivalent, for carrying or guiding the second thread within the range of the looper, substantially as described."

2. For an *Improved Method of Discharging Cargo from Canal Boats;* Amos Young, Georgetown, D. C.

Claim.—"I do not claim as new, of themselves, any of the devices named; but I do claim the method described, of discharging and transferring coal or cargo from canal boats, by causing the boat to free itself of its cargo by the settling or falling of the boat in the dock in drawing off the water from the latter, in such a manner that the cargo contained in one or more cargo boxes or trucks provided with suspension truck attachments or devices, as specified, is left suspended at its draft or floating level in the canal, on a suspension track or railroad built on the sides of or over the dock, whereby the cargo may be discharged from the boat with despatch, and with but little labor, and be run off at a high level to any distant place of transfer, and there be transferred from one receptacle to another without inconveniently detaining the boat, and whereby the many other advantages specified are obtained; the said cargo box, with its suspension truck attachments or devices, boat dock and suspension track or railroad, being arranged and operated together, as set forth, and the whole serving to economize time and labor, and reduce the cost of transit and delivery at a high level, in a practicable manner."

3. For an *Improvement in Certain Devices for Tonguing and Grooving Lumber;* Nicholas G. Norcross, Lowell, Massachusetts.

Claim.—"I am aware that a rotary planing cylinder has been arranged so as to have its cutter knives rotate in the direction in which a board was moved against it, and in such case a bar, or the equivalent therefor, has been employed to keep the board down upon the bench, when the cylinder has been arranged in the bench or under the surface of board dressed by it; I therefore lay no claim to any such disposition or operation of a rotary planing cylinder for planing boards, as the function of it is different from that of a rotary saw, the latter being made to cut entirely through a board, while the former only dresses it on one side of its surfaces, and cuts but a short distance below the same. The saw cuts into two opposite surfaces, or through the board, and in striking out of the board it leaves a ragged edge on the surface, while in striking into it the surface through which it enters is left smooth and without a ragged edge or fin. Now, as one of the sides of the board to be tongued and grooved is usually a planed surface, and that surface must be placed downwards on the bench during the operation of making the tongue and groove, it becomes desirable to have it jointed with a smooth edge, and this is done by making the teeth of the saw to run so as to cut into the surface of the board, instead of cutting out from the board and such surface. And I do not claim the improvement of making the tongue with two recesses, the same being accomplished by means of the extension of the teeth of the saws inward beyond the knives, as stated, but mean to claim such an arrangement of the teeth of the saws with respect to the cutter knives, and for the purpose of making the tongue and such channels or recesses. I also claim the mode of confining the upper saw or set of saws of either the tonguing or grooving cutters to its shaft, viz: by the combination of the two right and left threaded screws and the screw nut, the same being substantially in manner and for the purposes of ready adjustment of

the saw or saws, as stated. Also, the improvement of making one or both of the draft rollers with a groove, when such roller is arranged and made to operate with respect to the tonguing cutters or saws, as specified."

4. For an *Improved Device in Constructing Strap Iron Railing;* Matthias Lachenmaier, Philadelphia, Pennsylvania.

Claim.—"What I claim is, the manner described, of constructing and fitting together crimped wrought metal railing, by constructing the cross bars at the extremities of their crimps or bends with punched or pressed studs projecting, either successive pair in each bar, in opposite directions alternately, to form supports or stops to the bars on either side of their crimps, and on both sides or faces of the railing, to prevent the bars from slipping out of their crimped bearings, or from out of line with them; also, to relieve the crimps from injurious strain, and to divide strain, jerk, or pressure applied to the railing, or to one or more bars, over the several bars, whereby time and labor are economized in fitting together the railing, a simple and strong double cross-tie of the bars at their several crimps is obtained, and whereby a flatter crimp, without the usual adjuncts of bolts or rivets for tying the bars together, may be used, as specified; the said cross bars at one of their crimps or bends either being made with or without a centre stud fitting into a corresponding indentation in the adjoining bar, to serve as a starting point or centre for fitting the bars together, and to hold them in their crimps, substantially as specified."

5. For an *Improvement in Chargers for Fire Arms;* Wm. M. Storm, City of N. Y.

Claim.—"There are several 'chargers' already in existence, as Colt's 'powder and shot chargers,' and others; but I disclaim all interference with these, claiming in my charger the general arrangement of the parts, substantially as described, the same embracing the combination of the devices of a fixed rammer and moving ball nozzle, and with the latter of a plurality of ball columns, or distinct chambers, the whole operating as set forth."

6. For an *Improvement in Plates for Artificial Teeth;* Mahlon Loomis, Cambridgeport, Massachusetts.

"My invention consists in making whole sets, or the upper or lower halves or parts of sets of artificial teeth, all of porcelain; a half set consists of but one piece of material, there being no metallic plate, as in the usual way, but the same material of which the teeth themselves are made is used instead of a metallic plate."

Claim.—"I do not claim the process above set forth; in making sets of artificial teeth, I do not claim the spreading of a gum enamel over one side of a metallic roof plate upon which the teeth are fastened; nor the extension of the porcelain gum some way, and not entirely upon the roof; but what I claim is, the manufacture of whole or half sets of porcelain or mineral teeth, substantially as described."

7. For an *Improvement in Reed Boxes for Musical Instruments;* Mervin T. Lundfear, Manchester, Connecticut.

Claim.—"What I claim is, 1st, My method of inserting reed boxes in chambers of graduated length and depth and width, as described. 2d, Tubing or chambering the reed boxes, as described. 3d, Blocking the reed box and mortising the block when it overlies the locality of the reed, as described."

8. For an *Improvement in Processes for Distilling Rosin Oil;* Halvor Halvorson, Assignor to H. Halvorson and J. T. Heard, Boston, Massachusetts.

"It has been common in the distillation of rosin to mix it with alkalies, alkaline earths, or metallic oxides; also, that rosin and oil have been distilled from bricks and various other insoluble matters; I therefore do not claim any such mixtures of rosin for the purposes of distillation, as they do not have a specific action in the process that results from the employment of clay. I have found that in the use of clay, no pitch residuum is left in the retort or distilling vessel after distillation; whereas, with any of the other matters above alluded to as having been mixed with rosin, I have found a large residuum of pitch remaining after distillation. The clay, therefore, I have discovered to have, in some unknown manner, a specific action on the rosin in preventing the formation of the pitch residuum."

Claim.—"What I claim is, the combining clay with rosin, and subjecting the mixture to distillation, so as to produce therefrom an oily product, substantially as specified."

9. For an *Improvement in Distilling Apparatus;* Halvor Halvorson, Assignor to H. Halvorson and J. T. Heard, Boston, Massachusetts.

Claim.—"What I claim is, the rotary cup, the rake, and the discharge pipe, (made with a plexure,) or their equivalents, in combination with a still, and made to operate therewith, substantially as specified."

10. For an *Improvement in Spinning Cotton;* John W. Adams, Thompsonville, Conn.

"The nature of my invention consists in interposing between the spindle or bobbin or spool thereon, and the flyer, traveler, or cap, or the equivalent thereof, a carrier or carriers moving with the spindle, bobbin, or spool, over which the thread passes from the flyer, traveler, or cap, to the spindle, bobbin, or spool, so that the dragging or drawing of the flyer, or traveler, or thread, on the edge of the cap, shall be effected by the said carrier or carriers, the thread being in contact therewith, so that the power and the resistance shall at all times be at the same distance without reference to the varying of the winding diameter."

Claim.—"What I claim is, the employment of the thread carrier, substantially as specified, in combination with the central spindle for winding on with or without a bobbin or spool, and with the ring, groove, and traveler, or its equivalent."

11. For an *Improvement in the Couplings of Endless Chain Horse Powers;* Wm. E. Arnold, Rochester, New York.

"The nature of my invention consists in making the platforms or treads of grooved or fluted metallic plates, the grooves running crosswise, so that they shall form rack teeth to work into and drive the pinion; and also in the lip and groove and hooks on the platform for making the continuous chain, without using links, pins, or any rigid connexion between them."

Claim.—"What I claim is, the lips, the recesses, the hooks by which the series of platforms are united into a continuous chain platform, without any other fastenings than those afforded by their own peculiar shape, and thus avoiding the use of links, bolts, rods, or similar fastenings, substantially as described."

12. For an *Improvement in Operating Catches in Tool Holders;* John Allender, New London, Connecticut.

Claim—"What I claim is, the face plate with an eccentric groove or slot, in combination with the sliding catch, with a projection fitted to said groove, and so arranged as to traverse the catch by turning the plate, substantially as described."

13. For an *Improvement in Making Ships' Knees;* William Ballard, City of N. York.

"The nature of my invention consists in the formation of ship knees of bent pieces of timber, with the convex surface so combined with the concave surface of an angular piece as to support the bent piece, and prevent it from straightening, and at the same time form an angle to fit between the beams or parts of the vessel to be supported by knees. Such knees may be formed from straight pieces of timber by bending, and two knees may be formed from one piece, and thus the knees be connected together by the same piece intermediate with the bent parts; and the knees may be formed to a square, in-square or out-square, as desired."

Claim.—"What I claim is, the formation of ship knees, substantially as above described."

14. For an *Improvement in Hydraulic Heaters;* Wm. H. Churchman, Philada., Penn.

Claim.—"What I claim is, the attachment of all of the radiating or circulating tubes, in one or more series of rows, directly to the boiler or main receptacle for water, together with any and all equivalents thereof."

15. For an *Improvement in Adjusting the Packing of Pistons for Steam Engines;* J. Crabtree, Philadelphia, Pennsylvania.

"The nature of my invention consists in a peculiar mode of constructing and applying to the piston of an engine, a small open conical ring between two lugs cast on the inside of the main inner ring, so that by turning an adjusting screw bolt, (whose outer end projects through the cover of the piston,) the packing rings can be properly adjusted (tightened or loosened) without taking off the cylinder head, by means of a wrench or other suitable instrument, to be passed through an appropriate hole in the cylinder head or cover."

Claim.—"I do not claim the packing rings, concentric with and clasping the inner rings, nor the inner ring and packing rings in combination, nor adjusting the packing of pistons through a hole in the cylinder head; but what I claim is, the open conical ring, in combination with the lugs, or their equivalents, cast on the open inner ring, and the flanched adjusting screw, or its equivalent, the shorter adjusting screw and follower, arranged and combined substantially as described."

16. For an *Improved Means for Adjusting the Valves of Locomotive Engines;* Henry W. Farley, East Boston, Massachusetts.

Claim.—"I do not claim making use of the power of the locomotive, exerted through rollers placed beneath the rails, for the purpose of driving machinery, pumping, sawing, or performing other analogous operations; but what I claim is, the method of adjusting the valves of a locomotive engine, the drivers being revolved by rollers suitably placed to receive them, which rollers are driven by any suitable power, independent of the engine itself."

17. For an *Improved Cutter for Metallic Bars and Rods;* John Gallagher, City of N. Y.

"The nature of my improvements consists in providing as simple and efficient means for cutting bolts, nuts, &c., as is obtained by the use of shears for cutting metallic plates, it being well known that they are not adapted for the purposes to which my improvements refer; and in the construction of the machine described, simplicity and durability are combined, thereby affording a cheap and expeditious mode of accomplishing the object."

Claim.—"What I claim is, the arrangement of the movable cutting die in the eccentric lever, operating in connexion with the fixed cutter, as described."

18. For an *Improved Machine for Making Bed Pins;* Curtis Goddard, Edinburgh, O.

Claim.—"What I claim is, the combination of cutters in the hollow mandrel with the movable cutter operated by the pin pressing the cutter, or by a disk of metal moved by the pin, or other means substantially as set forth."

19. For an *Improvement in Straw Cutters;* Robert Hodgin, Barnesville, Ohio.

Claim.—"I disclaim the use of an endless belt for the purpose of feeding the straw or other material to the knife; but what I claim is, the straw rest for supplying the straw to the knife, said straw rest or rack being carried the entire length from rear to front end of the cutter box by an intermittent forward motion, as set forth."

20. For an *Improvement in Car Trucks with Adjustable Axles;* Archibald C. Ketchum, City of New York.

Claim.—"What I claim is, the combination of the sliding side pieces, the transverse sliding bar, and the lever, in the manner substantially as described, for the purpose of causing the axle boxes to move in such a way as to make the axles assume the form of radii or normals to the curve, and thereby keep the wheels in line with the track."

21. For an *Improvement in Trunk-Lock Hasps;* Conrad Liebrich, Philadelphia, Pa.

Claim.—"What I claim is, 1st, The so combining of a spring with a hinged hasp as that the lower or hinged portion thereof shall stand off from the trunk, substantially as described. 2d, The placing of the hasp catch in a solid projection, which enters the lock with the hasp catch, and takes all the strain incident upon the tendency of the lid to open, and thus protect the catch itself, substantially as described."

22. For an *Improvement in Harrows;* Washington F. Pagett, Stone Bridge, Virginia.

Claim.—"What I claim is, 1st, The constructing harrow beams of sections of iron, with the teeth wrought solid upon and with them. 2d, The combination therewith and arrangement of cross-rods with screw and taps, and pipes or tubes, or their equivalents, to keep the beams and sections in their places."

23. For an *Improved Arrangement of Spring Dies in Machines for Making Clinch Rings;* G. M. Patten, Bath, Maine.

Claim.—"I am aware that a lower die having a spring seat for discharging the manufactured article has before been used; also, that a spring clearer, differently arranged or operating in combination, has been employed in various eyelet machines for removing the eyelets from the punch or upper die as it ascends; such, therefore, I do not claim; but what I do claim is, the spring seat of the lower die and elastic clearers, when arranged and operating together, as specified, so that not only is the finished clinch ring forced

upwards out of the lower die, and detached from the upper one to permit of its easy removal by the bar in feeding forward, but also whereby the spring seat and clearer are made to act as elastic grippers to the ring, to hold or keep it in its seat till removed by the bar, to avoid breakage of the machine, and whereby the clearer serves as an elastic guide to the bar, to facilitate the entry or feed of the bar, and to keep it in a fair or flat position for the operation of the punch upon it, as specified; the said clearer and spring seat being hung and operated so as to exert a continual tendency to approach each other, both during the up and down stroke of the punch, as set forth."

24. For an *Improvement in Flexible Harrows;* Wm. B. and G. M. Ramsay, South Strabane, Pennsylvania.

"The nature of our invention consists in constructing a flexible harrow of three separate parts or squares, and making said squares of such proportions, and arranging them in such relation to each other, that one of their diagonal lines will run parallel to the line of travel, and the other transverse thereto, whereby we are enabled to obtain a greater breadth of sweep than is secured with a harrow composed of four parts, and arranged and joined together in the ordinary way, and also to connect the whole together by three hinges or flexible joints, arranged in the position of a right angle triangle, by which position we secure a greater freedom and diversity of motion than can be obtained by any other position of the same number of flexible joints or hinges."

Claim.—"What we claim is, the peculiar arrangement described and shown in the drawing of the three parts of the harrow and the three flexous joints connecting the same together, in combination with the construction of said joints, which allows of the several parts very freely and perfectly adjusting themselves up and down, independent of each other, in passing over the undulating surface of the soil, substantially as described. By thus arranging and combining the several parts of the harrow, we are enabled to simplify its construction, lessen its cost, and render it capable of making ten more movements than any other flexible harrow known, and consequently performing the harrowing operation more perfectly and speedily."

25. For an *Improvement in Machinery for Making Rope;* Wm. Robinson, Jr., Warsaw, New York.

Claim.—"What I claim is, 1st, The employment of the cogged ring, arranged and operating as described, for giving the flyers their independent rotation for twisting the strands, and by its own revolution regulating the amplitude of that twist. 2d, The employment of the rotary clamps, in combination with the cams and springs for grasping, conveying, and releasing the rope, as set forth."

26. For an *Improvement in Violins;* Sewall Short, New London, Connecticut.

"The nature of my invention consists in uniting or combining a metallic horn or trumpet with a violin, violoncello, bass viol, or instrument of a similar character, by which means the vibrations of the latter are greatly increased, and the tone and power of the instruments much improved."

Claim.—"What I claim is, the application of a trumpet or horn to violins, bass viols, and other similar instruments, in the manner described."

27. For *Improvements in Air Engines;* Philander Shaw, East Abington, Mass.

"The nature of my invention consists, firstly, in the employment of auxiliary heaters, which are so connected together and with each other, by means of valves, that the air for the supply of the engine shall be pumped in against the minimum pressure within the main heater, while it is worked off at the maximum pressure. Also, in passing the exhaust air from the cylinder, together with the smoke and heated gases from the furnace, through the auxiliary heaters in one direction, while the air for the supply of the engine is caused to pass in the contrary direction through tubes within these auxiliary heaters, by which means the heat is extracted from the exhaust air and smoke, and transferred to the air on its way from the air pump to the heater."

Claim.—"What I claim is, the auxiliary heater, constructed and arranged as set forth; the exhaust air and the products of combustion being passed through in one direction, while the cold air from the force pump is passed through in the other, by which means the heat is extracted from the heated air and smoke, and transferred to the cold air on its way to the engine, the latter being pumped in against a pressure much less than that at which it is worked off from the main heater, as explained. 2d, I do not claim the use of cold water for the purpose of refrigerating the cylinder or piston of hot air or other engines; but what I do claim is, the arrangement described, of the tubes within the piston rod, the reservoir, and the india rubber tubes."

28. For an *Improved Hydrodynamic Engine;* Le Grand C. St. John, Buffalo, N. York.

"The object of my invention is, to furnish the means of bringing into effective action the force passed by water in its rise and fall; it consists in the employment of a float connected by mechanism with the apparatus for letting the water to and from the chamber in which the float operates, together with mechanism for changing the motion produced by the rise and fall of the float with a continuous rotary motion."

Claim.—"What I claim is, the described arrangement of mechanism for operating the tube, so that it shall produce the alternate opening and closing of the ingress and egress passages, for letting water to the float, and drawing off the same, substantially as set forth. Also, the arrangement of the wheels, with their respective shafts and ratchets and pawls, for causing a continued rotary motion of the wheels, from the alternate motion of the float, substantially as specified."

29. For *Milker's Protector;* John M. Weare, Seabrook, New Hampshire.

"The object of my invention is to enable a milkmaid or person while milking a cow to secure the tail of the animal, so as to prevent it from being whisked about, or in other words, to prevent the cow from striking a person with her tail, an occurrence which is very common, and of great annoyance to those who perform the operations of milking."

Claim.—"I claim the combination of hamstring and tail nippers, applied together and made to operate essentially as described."

30. For an *Improved Rotary Planing Knife;* Elbridge Webber, Gardiner, Maine.

"The nature of my invention consists in combining peculiarly formed knives with oblique elliptical cutter stocks, and in arranging the same for the purpose of planing lumber."

Claim.—"What I claim is, the combination of the knives with the stock, constructed, arranged, and operated substantially as set forth."

31. For an *Improved Expansion Bit;* Asa Weeks, South Boston, Massachusetts.

Claim.—"I do not claim an expanding bit, nor making both of the cutters capable of motion, independent of each other; but what I claim is, the motion described, of connecting the two cutters with each other, so that they shall move out and in simultaneously and equably, as set forth."

32. For an *Improved Slotting Machine;* Parley Williams, 2d, Barre, Mass.

Claim.—"What I claim is, 1st, The mandrel, secured in the top of the column which supports the hub, serving with the aid of a key to hold the hub in place, and containing a slot on the side in close contact with the hub, which serves as a guide for the tool while cutting the slot in the hub, or other similar article, substantially as described. 2d, The combination of the wedge, the screw, and the spring, the wedge being placed in a recess in the mandrel behind the tool, and serving to feed and hold the tool to its work, the screw being attached to the wedge so as to bear on the top of the mandrel, and control the descent of the wedge, and the spring being attached to the tool so as to bear on the hub, and hold the tool back against the wedge, and thus prevent it overloading itself, all substantially as set forth. 3d, Attaching the tool to its stock by a button or knot at the bottom of the tool, fitting loosely into a slot in the top of the tool stock, which has a mouth narrower than the button, but which extends only partly across from the front of the stock, said slot being arranged in such a direction, and its narrow mouth being of such length as to allow the tool, while attached to the stock, to move back and forth as far as is required for the feeding operation, but to allow the tool to be withdrawn by moving it back beyond its most backward operative position, as set forth."

33. For an *Improvement in Hay Knives;* Seth Whalen, West Milton, New York.

Claim.—"What I claim is, attaching a blade made of sheet steel, and bent at its upper extremity so as to stand out from the handle, directly to and in the centre of the handle, and between the arms, whereby a great saving in time, labor, and expense in making hay knives can be effected, and an equal distribution of the power of the operator exerted in a perfect manner upon the edges of the knife, and it consequently caused to act more effectually upon the hay than the ordinary knife, substantially as set forth."

MAY 9.

34. For an *Improvement in Sewing Machines;* Simeon Coon, Ithaca, New York.

Claim.—"I claim the combination of the slot in the shuttle, and the pin or stud in the race way, or their equivalents, for the purpose of drawing the thread from the shuttle

bobbin, so that there may be an uniform tension upon the shuttle thread when drawing up the stitch, substantially as described. Also, in contradistinction from the double acting dog or pawl and ratchet, which changes the time of feeding forward the cloth relatively in regard to the motion of the needle, the separate pawls operated by a cam and levers, or otherwise, so that the feed, whether reversed or not, shall always remain relatively the same with regard to the motion of the needle, or so that the feed shall take place whilst the needle is going down or towards the cloth, and not when it is leaving the cloth to draw up the stitch, substantially as described."

35. For an *Improvement in Machinery for Dressing Flax;* E. L. Norfolk, Salem, Mass.

"My invention consists in a certain device for regulating the movements of the rollers which supply the flax to the machine, whereby the said rollers are made to feed the material at a speed corresponding inversely with the quantity passing between them, or to stop entirely when the quantity becomes so great as to render a stoppage necessary."

Claim.—"I do not claim the employment of trunks with movable lids, by the rising and falling of which the rate of feed is regulated; but I do claim governing the movements of the rollers which supply the material to the machine by means of wedges, which are suspended in such a way as to be caused by the rising and falling of the movable lids, or their equivalents, to rise and fall, and thus regulate the position of bars which are acted upon by eccentrics or cams for the purpose of transmitting motion to the feed, and thereby regulate the amount of motion which the said bars receive from the said eccentrics or cams, substantially as set forth."

36. For an *Improvement in Bee Hives;* Clark Wheeler, Little Valley, New York.

Claim.—"I do not claim either the box, the pendent valves, or reticulated screen, separately, or independent of each other, as they have been used before in moth traps; but what I do claim is, the drone trap, constructed as set forth, and operating in the manner described."

37. For an *Improvement in Sewing Machines;* Herman Crosby, Jr., Watertown.

Claim.—"I claim, 1st, The adjustable cam, or its mechanical equivalent, in combination with the friction brake, for the purpose of intermitting the action of the brake upon the thread during the feed, and thus obviating the danger of sundering the thread in rapid work during that movement of extreme tension, as set forth. 2d, Enlarging that portion of the needle which, having entered the material, is to retire from it before the pull upon the last loop is commenced, in the manner and for the purpose described."

38. For an *Improvement in Sewing Machines;* Christopher Hodgkins, Assignor to Nehemiah Hunt, Boston, Massachusetts.

Claim.—"I am aware that there is nothing new in moving the feeding wheel by means of a friction brake, knuckle, or clamp, and a lever combined therewith; I am also aware that for the purpose of operating a feed wheel, a combination consisting of a shaft with two arms, a screw regulator, a lever and clamp have been used; I therefore do not claim such devices; but I do claim the peculiar manner in which the brake clamp is constructed, applied to, and made to operate in the groove of the feed wheel, whereby the bearings of the clamp on the two opposite concentric surfaces of the groove, are curved concentric lines or surfaces, running parallel, or about parallel to the plane of the feed wheel, instead of perpendicularly to it, such an arrangement of the bearing lines or parts of the clamp rendering its hold on the wheel far more certain than when they are made in length only equal to the depth of the groove, and to stand perpendicularly to the plane of the feed wheel. I also claim the mode of operating the brake clamp or lever, or in other words, the arrangement and combination of the spring, the slide, cams, the lever, and the spring, as set forth, such mechanism causing the clamping of the lever brake to the feed wheel to be wholly done by mechanism, acting entirely before and separate from and not controlled by that which produces the movement of the clamp, by which corresponding extent of motion is produced in the feed wheel."

39. For an *Improvement in Sewing Machines;* Otis Avery, Honesdale, Pennsylvania.

Claim.—"I claim the so arranging the upper needle bar on a pivot, and controlling it by a spring, or their equivalents, as that it may be swung around to remove or replace the cloth, or other material to be sewn, substantially as described. Also, the arrangement and combined adjustment of the two needles, for the purpose of regulating the relative positions of said needles to each other, and their joint positions in relation to the

material to be sewn, substantially in the manner described. Also, the arrangement of an adjustable table or support for the cloth, with regard to two needles which have a fixed centre at which the stitch is formed, as that by raising and lowering said table, or the cloth, the stitch may be thrown to one side or the other, or in the centre thereof, substantially as described."

40. For an *Improvement in Seed Planters;* George T. Enoch and Daniel Wissinger, Springfield, Ohio.

"The nature of our invention consists in the method of adjusting or regulating at pleasure, the several parts for furnishing the proper quantities of seed to be sown."

Claim.—"We claim the mode of adjusting the tappet wheel, in combination with the peculiar form of the sliding bar, to suit the nicest differences in any desired quantity of seed to be sown, substantially as described."

41. For an *Improved Hub Borer;* William J. Casselman, Vernon, New York.

Claim.—"I claim boring taper holes through hubs by means of a lever, secured by a pivot to a rod, which is drawn through the mandrel hole of the hub, said lever having a cutter at one end and a pin at the opposite end, which pin fits in an oblique slot in an adjustable plate; the slot giving the proper movement to the cutter as it passes through the hub, as described."

42. For an *Improved Extension Bit Guard Key for Door Locks;* William Damerel, Brooklyn, New York.

Claim.—"I am aware that the key hole has before been plugged on the outside by the key from within, by means of an additional or swivel guard bit in front of the ordinary or main bit which operates the bolt; such, therefore, I do not claim; but I do claim so arranging and connecting the main bit of the key, or that portion which operates the bolt, with the shank of the same, as that the main bit may be thrown in or out of gear at pleasure with the shank, and extended so as to plug the key hole, or be moved inwards to form a firm connexion with the shank to operate the bolt, substantially as set forth, and whereby the many advantages specified are obtained."

43. For an *Improved Felloe Machine;* Heman H. Dean, Adrian, Michigan.

"The nature of my invention consists in the employment of a combination of devices for removing the concave felloe guide from the cutters, and also for regulating the approach of said guide and felloe to the cutters."

Claim.—"I do not claim the cutters, clamps, or guides; but what I do claim is, the combination of mechanism operating the guide, namely, the lever, rod, and springs, arranged and operating substantially as set forth."

44. For an *Improved Pump;* Jacob Edson, Boston, Massachusetts.

Claim.—"I claim, 1st, The tube, in combination with the air chamber, constructed and operating in the manner set forth. 2d, The cup, in combination with the holes and the packing, constructed and applied to a force pump, as described. 3d, The inclined partition in the rear of the spout, operating in the manner set forth."

45. For an *Improvement in Cultivators;* Chas. K. Farr, County of Hinds, Miss.

"My invention consists in the employment of a bed with sides inclining upwards and outwards, connected with the beam and handles of the implement, to the front of which is fastened an adjustable coulter; the object being to prevent the earth from falling into the furrow by the pressure of the sides of the bed, as the plough moves forward."

Claim.—"What I claim is, the bed with inclined sides, as described, which following the trace of the coulter, renders the sides of the furrow compact, and prevents the falling in of the earth, substantially as set forth.'

46. For an *Improvement in Bridges;* Albert Fink, Baltimore, Maryland.

"The nature of my invention consists in combining different systems of triangular bracings, in the manner described, so that a weight coming on one of the systems of the truss is not only carried over one or more other systems before it is carried back to the abutment, but the foot of the post of each triangle shall be capable of settling vertically, or moving to the side, so that the tension rods of each system of the triangular bracing will be strained equally when the bridge settles under a superincumbent weight."

Claim.—"I do not claim as new, the manner in which the central post is supported; nor do I claim the combination of a series of triangular bracings in such a manner that

one system of triangles is supported by and dependent on the other, merely, as I am aware that this has been done before, both in trusses for bridges and roofs; but what I do claim is, the method of combining the different systems of triangular bracings described, so that a weight coming on one of the systems of the truss, is not only transferred over one or more other systems before it is carried back to the abutments, but the foot of the post in each triangle being unconnected with the tension rods of the other triangular bracings, can settle vertically, as well as move to the side, so that the tension rods of each system of the triangular bracings will be strained equally when the bridge settles under a superincumbent weight. This would not be the case if the foot of the post in the second system of triangular bracings rested on the tension chord of the post in the first system, as heretofore used, and herein consists my improvement."

47. For an *Improved Journal Box for Saw Mill Carriage;* Chas. R. Fox, Chicago, Ill.

Claim.—"I claim the construction of the boxes with the opposite inclined inner faces for giving the requisite set off to the carriage when gigging back, and again setting up when moving forward for the cut, substantially as set forth."

48. For an *Improvement in Machinery for Cutting Paper;* Nelson Gavitt, Phil., Pa.

"The object of my invention is to give to the machine the capacity of varying the length of the sheets cut from the web to any degree, small or great, within the two extremes of length to which the machine is adapted, and to produce such changes while the machine is at work."

Claim.—"I am aware that conical rolls encircled by a shifting belt, as a device for varying the relative velocity of different parts of a machine, has long been known, and I do not claim it; but I do claim the method, substantially as described, of adjusting the cutting of sheets from a web of paper, whereby the length of the sheets can be varied by any required proportionate amount of the whole range of variation to which the machine is adapted, however small or however large the same may be, thus rendering it possible, with continuous feed of the web of paper under an intermittent cutter, to sever the sheets half way or thereabouts, between water marks, nearer together at one part of the web than at another."

49. For an *Improved Arrangement of the Pestle with the Mortar;* Platt C. Ingersoll, Elmira, New York.

"The nature of my invention consists in combining the pestle with the mortar by means of a ball fitted to a corresponding cavity in a spring bar connected with the mortar. And also, in connecting the universal joint in which the pestle works with the mortar, by means of a spring bar, the said bar being so connected that if desired, it can readily be attached or detached."

Claim.—"I claim the manner of arranging and combining the pestle with the mortar by means of the ball on the handle of the pestle, fitted to a corresponding cavity in a spring bar, substantially as specified."

50. For an *Improved Method of Unloading Canal Boats and other Vessels;* William Longbridge, Weverton, Maryland.

Claim.—"I am aware that vessels have been made with valves or traps in their bottoms, for the discharge of their loads of earth, mud, &c., as in the case of J. R. Putnam's patent of May 6th, 1841, and the withdrawn case of Sophia Putnam, of June 28, 1847; I am also aware that vessels have been floated into dry docks, and the water drawn off through valves, leaving the vessel dry and supported upon blocks or upon trucks; I therefore do not claim either of these devices, or in that of the shute; but what I do claim is, the method or process of unloading vessels described above, by means of the combined arrangement of the vessel with valves in the bottom, the dry dock with valves immediately below those in the vessel, and the shutes to carry off the load into boats or other receptacles placed below, but not immediately under the elevated dry dock, all as described."

51. For an *Improved Manure and Sand Loader;* Horatio G. Marchant, Annisquam, Massachusetts.

Claim.—"I claim the transportable manure loader, consisting essentially of the following elements in combination, viz: the body or box, the trough, and the rake, constructed and arranged substantially as described."

52. For a *Machine for Reducing Wood to Slivers;* Jonathan Prescott and George W. Prescott, Boston, Massachusetts.

Claim.—"We claim the arrangement of the planes, so that each shall cut not only

with a drawing stroke, but shall curl the shavings in helices, as specified. And, in combination with the feeding carriage and the feeding screen, we claim the movable straddle or sliding block, and the scroll cam of the screw, the same being made to operate together, substantially as specified. And we claim the tripping rest as combined with the weighted lever and the feeding carriage, and used as specified."

53. For an *Improvement in Bleaching Apparatus;* J. Augustus Roth and Joseph Lea, Philadelphia, Pennsylvania.

"The nature of my improvement consists in so arranging a series of rollers in a vat that a considerable number of continuous strips or sheets of cotton or linen fabric may be simultaneously drawn through the vat, said fabrics being fully spread out. The advantage of the improvement is, that the fabric may be thoroughly acted upon by the bleaching or boiling solutions, with a great saving in time and expense over the ordinary method."

Claim.—"We do not claim the arrangement of rollers in a vat, generally; but what we claim is, the arrangement of the series of graduated and compensating upper and lower rollers, in combination with the vat, for the purpose of treating simultaneously a series of parallel layers of woven fabrics, in the manner substantially as described."

54. For an *Improved Machine for Marking Out Sash;* James Rogers, Poultney, Vt.

"The nature of my invention consists in setting out the heads of the mortises in sash or other small work, with two or more mortises in each piece, and two pieces at the same time, and upon both sides with the same motion."

Claim.—"I claim the movable knives or markers, movable stops and sliders, their equivalents, and manner of adjusting the top, and of causing markers in the top to correspond with the bottom markers, and manner of applying the scales to the machine, substantially as set forth."

55. For a *Machine for Weighing and Printing Butter;* William S. Reinert, Philadelphia, Pennsylvania.

Claim.—"I claim the combination of the mould or vessel for containing the butter, suspended to the lever or scale beam, and its attachments, plunger, or piston, having the desired configuration on its lower surface, and upright rod and button for raising the circular plate or piston in the bottom of the said vessel or mould, together with the levers for operating the same, for weighing, forming, and branding, or imprinting with any desired configuration, the butter in parcels, and discharging the same from the vessel or mould, substantially as set forth."

56. For an *Adjustable Flue Bottom of Steam Boilers;* Alexander M. Sprague, Mobile, Alabama.

Claim.—"I claim the movable adjustable bottom of the flue space under the boiler or boilers, so constructed and arranged that it may be raised and lowered, or adjusted to graduate the size of the flue under the boiler or boilers, and adapt such flue to the kind of fuel used, substantially as described. Also, in connexion with the above-mentioned movable adjustable bottom, the inclined vibrating piece or bridge, or its equivalent, so constructed and arranged that it will operate with the bottom, and conduct the flame from the furnace into the flue under the boilers, substantially as described."

57. For an *Improvement in Pistons for Steam Engines;* Alexander M. Sprague, Mobile, Alabama.

Claim.—"I claim making the body of the piston in two parts, substantially as described, so that the hub and disk or body, or centre portion of the piston, can be removed, with the piston rod, in the same direction that the follower or cap is taken off, and replaced, without removing the outer portion or barrel and flanch that supports the packing."

58. For an *Improvement in the Construction of Hatches;* Daniel Tallcot, City of N. Y.

"The nature of my invention consists in attaching to the axis or pivot of each door of the hatch a half pulley, to which a lever is connected by a chain or rope, said lever being so constructed and arranged that the carriage, in its descent, will operate upon said levers and open the doors, allowing the carriage to pass through them; the doors, after the carriage has passed through them, closing by their own gravity; the falling or closing of the doors being graduated by means of springs."

Claim.—"I claim causing the doors of the hatch to be elevated or raised as the carriage descends, by attaching to one of the pivots of each door a half pulley, which is connected by a cord to a lever, said levers having curved arms, which project a short distance beyond the edge of one of the uprights, so that they may be operated upon by one of the rollers the doors being counterpoised by the spiral springs, or their equivalents, as set forth.

59. Fc an *Improved Arrangement of Friction Roller in Inclined Plane Hinges;* Enoch Woolman, Damascoville, Ohio.

Claim.—"I claim making and arranging the roller so that it can be traversed towards and from the pivot of the hinge, in combination with the scores in the inclined planes, so that it can be used either as a self-shutting or self-retaining, when open or partially open, substantially as described."

60. For an *Improvement in Locomotive Fire Box;* Ross Winans and Thomas Winans, Baltimore, Maryland.

Claim.—"We claim the downward and rearward inclination of the top or roof, when this is connected with the flat grate surface and the usual feeding hole or door, and with or without the fuel feeding boxes through the roof, as set forth."

61. For an *Improvement in Screw Jacks;* Francis Davis, Keene, Assignor to J. Mason Reed, Swansey New Hampshire.

"My invention consists in the use of a right and left screw with the head or sockets for the operating lever between them, whereby the latter is removed to an equal distance from the top and bottom ends of the jack, and the motion of the head of the jack is double that of the ordinary screw jack for an equal motion of the operating lever, and in an equal space of time, by which means a great saving of time and power is effected."

Claim.—"I do not claim the use of a right and left screw, as this has been made use of before; nor constructing a screw jack entirely of iron; but I do claim as a new tool or instrument for the purpose of raising heavy bodies, the above described jack, constructed and operating in the manner set forth."

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62. For an *Improved Clap Board Joint;* Wm. Baker, Utica, New York.

"The nature and principal object of my invention is, so to construct and form the boards for the siding of houses, that in putting them together and nailing them to the frame of the building, the heads of the nails may be covered, while, at the same time, the chief characteristic of clap boarding, the overlapping of one board upon another for shedding the water, shall be preserved."

Claim.—"I claim the combination of the lock in the rear of the joint with the extended lip in front, constructed and used in conjunction for the purposes of effecting the objects of the invention, as specified, the whole being constructed, combined, and arranged substantially in the manner set forth."

63. For an *Improvement in Harvester Rakes;* Cyrus Roberts, Bellsville, Illinois.

Claim.—"I claim the fingers, arranged as described, and operated by means of the eccentric rod and lever, in combination with the fork, constructed and arranged with a curved slot through it, in which the pin or arm fits, and operated by the crank, for the purpose of removing the cut grain from the platform."

64. For an *Improved Lath Machine;* Hiram Frisbee, Olmstead, Ohio.

"The nature of my invention consists in hanging the log upon centres, in a carriage which moves the length of the log backward and forward on a frame, in which revolve circular saws at right angles to each other, for the purpose of cutting off the lath from the log as it traverses over the saw. Also, in the combination of devices for adjusting the log to the saws, so that lath or strips of any desired thickness or width may be cut from the log, and also in revolving the log by the action of a ratchet, the thickness of a lath, immediately on each strip or lath being cut from the log."

Claim.—"I claim the combination of the movable cam block, stay lever, ratchet dog, and weight, for the purpose of successively turning and griping the log in the following manner: the ratchet dog rotates the log the thickness of a lath as the stay lever passes over the movable cam block; in the instant the stay lever passes the movable cam block the stay lever is reversed by the action of the weight, causing the log to be griped and

held stationary by the point of the lever during the process of sawing. The act of turning and griping the log takes place alternately, as the carriage traverses backward and forward in the direction of the arrows. I claim the adjustable rollers and slides, and the adjusting screws with the slides, as described."

65. For an *Improved Rotary Shingle Machine;* Wm. Stoddard, Lowell, Mass.

"The nature of my invention consists of a wheel in which is placed the riving knives, and also the shaving knives and springs, and other apparatus, as shown in the drawings, for adjusting the same, for splitting or riving and shaving shingles by the rotary motion of the wheel in which the knives are placed.

Claim.—"I claim, 1st, The riving knives, the springs to which they are attached or secured, and the dressing knives, the beveled flanched wheel, when they are arranged and operated as shown and described. 2d, I claim the arm, placed at or near the centre of the wheel, or its mechanical equivalent, when made and used for the purposes of sustaining the shingles while the knives are dressing them, as set forth. 3d, I claim the levers, in combination with the springs, for supporting the four springs near the periphery of the wheel, during the dressing of the shingles, substantially as set forth."

66. For an *Improvement in Self-Heating Smoothing Irons;* Chas. A. Read, Waterloo, New York.

Claim.—"I claim, 1st, Making the holes which supply the air to the lamps above the holes through which the lamp tubes are inserted, so that the air, as it enters to supply the lamps, will deflect the flame down towards or against the bottom, to heat it more rapidly and effectually than it would otherwise do, and heat the top less, substantially as described. 2d, Making the inside of the top descend gradually from rear to front, to aid in deflecting the flame down towards or against the bottom, so as to heat it more effectually."

67. For an *Improvement in Tables for Ships' Cabins;* William L. Bass, Cambridgeport, Massachusetts.

Claim.—"I claim a table for ships' cabins, &c., which is formed in sectional pieces by the backs of two opposite rows of adjacent chairs, the said backs being sustained and operated as described, and also susceptible of being reconverted into the backs of chairs, as set forth."

68. For an *Improvement in Surgical Splints;* Smith A. Skinner, Browington, Vt.

Claim.—"I claim the combination and arrangement of the long bar, made to extend above the hips, and to have a counter extension strap applied to its upper part, the thigh and leg rests, and the extension screw applied to the bar, the whole being substantially as specified. And in combination with the long bar and counter extension strip of the groin, I claim the projecting screw arm and its body rest, the same being for the purpose of obtaining extension in direct line of the leg, as stated. I do not claim the application to a simple foot rest and a bar to extend up the leg, of a device for producing lateral movement of the foot rest; but what I claim is, the combining the connected thigh and leg rests with the bar by means of two slide rods and slides, and their set screws, as specified, whereby the whole, the combined thigh and leg rests, may be readily and properly adjusted to any leg, whatever may be the degree of projection of the hip thereof."

69. For an *Improvement in Knitting Machines;* Israel M. Hopkins, Pascoag, R. I.

Claim.—"I claim, 1st, Attaching the locking bars to the same plate or head with the presser bar, in such a manner as to allow them a limited movement, irrespective of the plate or head, under the influence of springs, applied substantially as described, whereby the said bars are enabled to lock the jaws some time before the termination of the descent of the presser bars to close the barbs, and hence, before the commencement of the retreat of the needles, but the necessary continuation of motion of the plate or head to bring down the presser bar is not prevented. 2d, The combination of the spring and the plate attached to the traverser and the tongues attached to the needle bar, the several parts operating substantially as described, to arrest or retard the thread, or produce a back drag, as may be required to tighten the selvage, at the commencement of each row of loops."

70. For an *Improvement in Moulding Clay Pipe Couplings;* J. Putnam, Salem, Mass.

Claim.—"I claim the manner of making the mould, viz: a combination of the two

conic frusta, and their separation cylinder or cylinders, together and with the concave cylindrical block, and the end boards, as specified, the two parts of the core being supported on a spindle that rests on a concave block, and concentric with its curved surface, as specified. I do not claim the mere use of cloth, or an inelastic fabric, to prevent adhesion of the clay to the moulding surface, but I claim the employment of stocking net, or an equivalent elastic material, for the cover or covers on the two parts or frusta of the core, the elastic properties of such cover or covers enabling them to fit closely to the curved surface of the cone without the formation of injurious seams or indentations on the inside surface of the coupling, and besides this, the elasticity of the cover or covers facilitates the removal of the same from the moulded article. I also claim the wire former, made substantially as specified, viz: of a curved wire or blade, the tension stay, and cutter or wire, and the forked stock or handle, the whole being used as specified."

71. For an *Improvement in Water Indicators for Steam Boilers;* Thomas J. Sloan, City of New York.

Claim.—"I claim connecting the float inside the boiler or other vessel with the indicator or mechanism outside, by means of a flexible sleeve or sleeves, or the equivalent thereof, substantially as and for the purpose specified."

72. For an *Improvement in Machinery for Combing Wool;* Chas. G. Sargent, Lowell, Massachusetts.

Claim.—"I claim, 1st, Giving to the feeding apparatus the lapping motion, substantially as specified, by the crank and rockers, or their equivalents, for lapping the fibres of wool on to the teeth of the main comb. Also, in combination with the feed rollers, operated substantially as specified, the employment of the lifting rod, for lifting the fibres preparatory to lapping them on to the teeth of the main comb, and then separating them. Also, in combination with the continuous chain of main comb teeth on which the fibres of wool are lapped, a working comb, which is operated by a peculiar motion like that given to the lapping rollers, by having the said working comb attached to and carried by a frame, operated at one end by a crank, or the equivalent thereof, and jointed to vibrating rods or workers, substantially as specified. I also claim, in combination with the main comb teeth, and with the lapping feed rollers, and the working comb, the employment of a brush or brushes, substantially as described, for holding the fibres of wool after they have been lapped on to the main comb teeth, to prevent them from being drawn out before they are combed. Also, in combination with the endless chain of comb teeth constituting the main comb, the vibrating finger, operated substantially as described, to direct the fibres of wool after they have been combed to the rollers which draw them off and deliver them to the condensing apparatus. I also claim giving to the feed rollers an intermittent rotary motion, substantially as specified, that the required quantity of wool may be fed forward for each lapping motion, and then stop during the pulling or separating. And, finally, giving to the rollers of the condensing apparatus which strip the fibres of wool from the teeth of the main comb, a slow vibratory motion in the direction of their axes, as specified."

73. For an *Improvement in Baths for Coating Metals with other Metals;* Geo. Rogers, Enfield, England.

Claim.—"I claim constructing the bath in such manner that the upper portion of the molten metal at which the article to be coated enters, is separated by a partition from that portion of the upper part of the molten metal at which the coated article emerges, whereby the flux at the two ends of the bath may be kept separate, and the metal at one end of the bath kept at a much higher heat than at the other, substantially as specified; whereby also, pulverulent matter not being a good conductor of heat, may, with important advantages, be employed to cover a portion of the surface of the molten metal, the remainder being covered by flux."

74. For an *Improvement in Knitting Machines;* Henry Burt, Assignor to the Newark Patent Hosiery Company, Newark, New Jersey.

Claim.—"I claim, 1st, The method of constructing the pattern cylinder; that is to say, by dividing the same into two parts, so as to be capable of sliding to or from each other on the supporting shaft, whereby variations in the width of the web may be effected, but having the same pattern. 2d, Combining the pattern cylinder directly with the shifting bar, carriages, and yarn guide, as described, whereby I am enabled to economize space and produce a better action in the machine. 3d, The improved construction of

the carriage and stop motion, by the addition of a second carriage, on which the stop levers and yarn guide are fixed; and these I claim in combination with the shifting bar, as set forth. 4th, I claim attaching the point of the yarn guide by a hinge, and so shaping it that it may be pressed down between the needles to form the selvage, as described. 5th, I claim the hook bars and its hooks, in combination with the needles and sinkers, substantially as set forth."

75. For an *Improved Water Wheel;* Abel Greenleaf, Kingston, Pennsylvania.

Claim.—"I claim, 1st, The combination of the gate with the scroll, substantially in the manner described. 2d, The recess and the apertures leading thereto, in combination with the leather, or its equivalent, substantially as described. 3d, The spiral or wedge-like form given to the portions of the wheel, as represented, in combination with the buckets thereof, substantially as described. 4th, The tapering form given to the floats, in combination with the double cone-like shape given to the portion of the hub to which they are attached, substantially as described. 5th, The change of curvature in the buckets at or near their ends, as shown, arranged so that these ends shall not be overlapped by the ends of the adjoining buckets, substantially as described."

76. For an *Improvement in Machines for Pegging Boots and Shoes;* Leander Lackey, Sutton, Massachusetts.

Claim.—"I claim, 1st, The hanging jack or last-holder by universal joint, so arranged as to press against points of inclined spur wheel, and held firmly at proper time by clamp or analogous device. 2d, The receiver, when this is so combined with a concave guide in which it revolves as to receive the peg directly as it is cut from the block, and convey it directly to the hole pierced by the awl. 3d, In combination with the revolving receiver, I claim the awl and punch when made to operate alternately through the compartments thereof, for the purpose of piercing the hole and driving the peg; it being understood that I do not claim, in general, the device of making the awl and punch act alternately with each other, as that is not new. 4th, The rolling spur wheels on which the shoe rests, and is carried at certain times the precise distance for the series of pegs, either for single or double rows. 5th, The manner of making the pegs by cutting them on the box or hopper, as set forth, and feeding along the cord by the alternate motion of a catch operating on the points of the card. 6th, The annular guide that supports the toe while the shoe is being pegged round the heel, and also supports the heel while being pegged round the toe. 7th, The waved cam for the purpose of raising and depressing the shoe to place the pegs in alternate rows. I am aware that one or more of the above-mentioned devices may be dispensed with in some kinds of work; I therefore do not claim the whole as a necessary combination; but I use the whole for common large work, reserving the right to use less or more, as required."

77. For an *Improvement in Ox Yokes;* Heman B. Hammon, Bristolville, Ohio.

"The nature of my invention consists in securing over the end of the bow a ferrule, and securing the bow in the yoke beam with the washers."

Claim.—"I do not claim the ferrule and washers, separate, for they are used for different purposes; but what I do claim is, the combination of the ferrule, or its equivalent, and the washers, for fastening of bows, as set forth."

78. For an *Improvement in Shower Bath;* Daniel P. Baldwin, San Francisco, Cal.

Claim.—"I claim the manner of combining the two directors, and providing one of them with large and the other with small discharge holes, and arranging them so as to be capable of being revolved when it is desired to vary the direction and quantity of the water discharged, and thereby increase or lessen its force upon the body of the bather, substantially as described. 2d, The manner of applying the three-way cock to the supply pipes of the directors, so that warm and cold may be supplied at the same time, and mixed and discharged together, through either of the directors, or warm and cold water supplied and discharged separately, as may be desired, substantially as set forth."

79. For an *Improvement in Hay and Cotton Presses;* Levi Dederick, Albany, N. Y.

Claim.—"I claim, 1st, The bar hinged to one of the doors, and capable of being removed therewith from the opening, in combination with the caps, by which it is retained immediately over the ends of the two doors, effectually assisting the pressure from within and keeping them closed during the operation of pressing. 2d, Providing the caps with flanches on the interior sides, by means of which the bar is enabled to aid in sup-

porting and binding together the two sides of the press during the greatest strain upon them."

80. For an *Improved Fastening for Ear Rings;* Geo. E. Higgins, Syracuse, N. York.

Claim.—"I claim the standard attached to the knob, and serving at the same time as a means of connecting the drop, and as a catch to receive and secure the end of the ear wire, substantially as described."

81. For an *Improved Lathe for Irregular Forms;* Frank Baker, Pepperell, Mass.

Claim.—"I am aware that in the turning lathe of Blanchard, a right last has been turned from a left last, or a left last from a right last; I therefore do not claim such as my invention; but what I do claim is, the particular arrangement of the cutting cylinder, the two patterns, the patterns, and work mandrel, and their tracer rollers, whereby they are made to operate together, substantially as described."

82. For an *Improvement in Trip Hammers;* Bernard Hughes, Rochester, New York.

Claim.—"I claim adding to the stem or rod of the trip hammer a piston working in a cylinder, open on the upper end and closed at the bottom, and provided with regulating cock and valve, substantially as described, by which means I am enabled to add the whole or such part of the pressure of the atmosphere as may be desirable to the weight of the hammer in giving the blow."

83. For an *Improved Catch for Holding the Bit in Brace Stocks;* Charles M. Daboll, Assignor to himself and Austin P. Daboll, New London, Connecticut.

Claim.—"I claim the improved manner of securing and detaching the bit in and from the socket of the brace, by means of the eccentric catch, and the inclined side of the notch in the shank of the bit, operating as described, viz: in such a manner that any force exerted to with the bit will bind it tighter in its place without straining said catch, and by which a slight pressure upon the thumb lever, combined with the catch, as specified, will release its hold upon the bit."

84. For an *Improvement in Machines for Cutting Glazier's Points;* Ward Eaton, Carbondale, Pennsylvania.

Claim.—"I claim the combination of a partially serrated or indented and straight cutter, having a reciprocating vertical motion, with a stationary blade, so that the serrated part of the blade shall cut out one-half of the sheet in points, and at the same time form two of the three sides of the remaining points of the sheet, which are cut therefrom by the straight blade, and thus cut up the entire sheet without waste; and this I claim only when said cutting edges are so inclined to each other as that but one point of the series cut from the sheet shall be cut off at a time, which prevents their warping or bending, substantially as described."

85. For an *Improvement in Potato Diggers;* Chas. H. Dana, West Lebanon, N. H.

Claim.—"I claim the revolving separator, constructed and operated substantially as described, for the purpose of breaking up the raised furrow slice, and separating the potato therefrom."

86. For an *Improvement in Gun Locks;* James Hults, Berlin Township, Ohio.

"The nature of my invention consists in such a construction of a single-triggered gun lock, that it can be readily adjusted in such a manner that the cock can be detached from its cocked position by the slightest touch upon the trigger, or in such a manner that a smart pull upon the trigger will be required to detach the cock from its catch, and when adjusted in the former manner the cock will be held securely until the trigger is touched, by which I am enabled to give to my improved lock all the advantages of the double-triggered lock, and with less liability to accidents."

Claim.—"The combination with the tumbler of a lock, of the jointed levers and the spring, substantially in the manner set forth. Also, the set screw, arranged in such a manner in relation to the jointed levers, the sear, and the tumbler, that by its adjustment the cock can be detached from its cocked position by a greater or less exercise of power upon the trigger, substantially as set forth."

87. For an *Improved Method of Hanging Gates, &c.;* N. W. Cilley, Nottingham, N. Y.

Claim.—"I am aware that a system of connecting levers or links have been used, called the 'parallel motion,' for connecting the end of the working beam with the piston

rod in steam engines, and that the same arrangement has also been applied to other machines to impart a rectilinear motion from a vibrating circular motion; therefore I do not claim any such device; but what I claim is, the method of suspending gates or other structures to bracing levers, jointed to each other and to the gate, or other structure, and to the fixed work, substantially as specified."

88. For an *Improvement in Machinery for Composing Type;* William H. Mitchell, Brooklyn, New York.

Claim.—"I claim, 1st, The combination of the lip with the lifting bar, and with the bar, as specified, the said lip acting as a stopper, against which the line of the type lies in the inclined conductor, and over which the bar lifts the bottom type, so that it falls on the bed, as specified, and the said bar being so adjusted as only to admit of one type at a time being lifted. 2d, Constructing the composing wheel of thin circular plates with teeth therein, so as to receive the type from the conductor, in combination with the plates, which pass between the circular plates and receive the type, preventing their further descent and passing them in line into the groove, as specified. 3d, The tongue to prevent the type jumping over the teeth in the composing wheel as they pass down the inclined conductor, as specified."

89. For an *Improvement in Fire Arms;* Jeremiah Peck, New Haven, Connecticut.

Claim.—"I claim the combination of the independent lever with the cylinder, when so arranged that the cylinder may be revolved and locked, without reference to or use of either the hammer or trigger, and the whole is constructed and combined substantially as described. Also, the combination of the spring shield with the cones or nipples, when so arranged as to cover and protect the caps, without any risk of injuring them, or moving them out of place, and also serves to prevent the recoil of the cylinder, when constructed and combined substantially as described."

90. For an *Improved Portable Grinding Mill;* Lyman Scott, St. Louis, Missouri.

Claim.—"I claim the alternate deep and shallow sections of furrows upon the main grinding surface of the burr, for the purpose of distributing the material over said surface, and preventing a surfeit or clogging upon any one point of said grinding surface, substantially as described. I also claim the method of supporting the shell and adjusting the burr therein, by means of the lower bridge-tree, grooved legs, sockets, and adjusting screw rods. when said legs serve the double purpose of supports to the shells, and guides to the bridge-tree, substantially as described."

91. For an *Improved Saw;* Linus Stewart, Washington, D. C.

Claim.—"I claim the construction and arranging of the saw teeth, substantially as described; that is, each tooth shall project beyond the next one below it, a distance equal to the depth it is intended to cut, and each tooth having its forward edge or sole vertical and parallel to the corresponding edges or soles of all the other teeth, for the purposes set forth."

92. For an *Improved Machine for Paging Books;* Horace Taylor, Springfield, Mass.

Claim.—"I claim the type holder, constructed and operating in the manner substantially as set forth. I also claim the peculiar combination and arrangement of the spring catch, the dog, the ratchet wheel and the pawl, whereby the printing cylinder is held firmly clamped during the operation of printing, and is revolved a sufficient distance to bring a new number over the platen, in the manner set forth."

93. For an *Improvement in Guitars;* Wm. H. Towers, Philadelphia, Pennsylvania.

Claim.—"I claim, 1st, Passing the strings through openings in the pins extending from end to end and over their flared and rounded heads, and thence to the head of the finger board of the guitar, for the purpose of increasing the volume and richness of its tones, substantially as described. 2d, Extending the two centre pins to the bottom board of the guitar, against which their lower ends are made to press by the pins, so as to cause them to act as sounding posts, in addition to serving as hold-fasts for the strings, as set forth."

94. For an *Improved Mode of Attaching Blankets to Cylinders for Printing Presses;* William H. Street, City of New York.

Claim.—"I claim attaching one end of the blanket to the cylinder by a row of pins arranged within the cylinder on one side of the opening which receives the gripper shaft,

and the other end to a toothed bar, which occupies a position within the cylinder, and has a screw applied in any way substantially as described, to draw it inwards to tighten the blanket."

95. For an *Improved Mitre-Box;* Mattew Spear, Bowdoinham, Maine.

Claim.—"I claim the two supporters or lumber bearers, connected and turning about a common centre, in combination with the saw guide attached to the same pivot, and so connected by mechanism with said supporters as to cause it at all times to bisect the angle at which the supporters may be set. Also, the turning of the saw guide from its vertical position, as set forth, for cutting any desired angle with the plane of the lumber supporters, substantially as specified."

96. For an *Improvement in Ox Yokes;* Isaac Little, Newbury, Massachusetts.

Claim.—"I claim the making of the yoke in two parts, scarfed, bolted, and confined together, as set forth, and combining with them the sustaining chains, the chain holder, and the stirrup screw and nut, all substantially as specified."

97. For an *Improvement in Self-Heating Smoothing Irons;* Peter S. Howes, Boston, Massachusetts.

Claim.—"I do not claim the combination of a rotary box, a supporting bale or handle, and a spirit lamp, the box being provided with two smoothing faces or surfaces of flats, and made to turn around within the handle, so as to bring either of them downwards after it has been heated by the flame of the wick of the spirit lamp; but I do claim the mode by which I prevent the swashing of the alcohol in the lamp, for causing too great or sudden a flowage of the alcohol through the wick, meaning to claim the air vessel, in combination with the tube, its seat, and the capillary covering, the same being applied together, and in the reservoir of the lamp, and to the wick thereof, and made to operate substantially as specified."

98. For an *Improved Lathe Dog;* David M. Smith, Springfield, Vermont.

Claim.—"I am aware that there is nothing new in a screw stirrup, as applied to the mandrel or centre pin of a common turning lathe, and for the purpose of confining the said centre pin to the puppet head of the lathe; I therefore do not claim such: but what I do claim is, combining the stirrup to the eye of the lathe dog, so that the eye part of the dog shall be made to extend through into the stirrup, and the male screw of the dog be made to screw through the stirrup and against the end of the dog, as stated. Also, to combine a cross bar or rod with the tines of the stirrup, so that the said cross bar shall pass through the eye of the stirrup, and serve to keep the parts together, or from entirely separating when not in use, as specified."

99. For an *Improved Method of Nibbing Saw Teeth;* P. B. Tyler, Springfield, Mass.

Claim.—"I do not claim the making a saw with detachable teeth, where the whole of each tooth is constructed in one piece and detachable from the body or plate of the saw; but what I do claim is, the improved mode of making and fitting each tooth, the cutting nib of it being made so as not only to embrace a rib made in the tooth or body of the saw, but to rest in an angular notch, formed as stated, at the front of the nib, the nib being secured in place by rivets, as specified."

100. For an *Improved Case for Holding Railway and other Tickets;* Joseph Edmondson, Salford, and Caleb Haworth, Marsden, Executors of Thomas Edmondson, late of Salford, England.

Claim.—"We do not limit ourselves to the details set forth, as the same may be varied; but what we do claim is, the case shown in figs. 1 and 2, for holding railway or other tickets."

101. For an *Improvement in Hydraulic Heaters;* Lewis W. Leeds and R. Morris Smith, Philadelphia, Pennsylvania.

Claim.—"We claim the arrangement of air tubes, forming a perforated chest containing the water to be heated, in connexion with the fire chamber therein, thus making a compact portable hot water apparatus of short circulation and efficient action, at a greatly reduced cost, in the manner set forth."

102. For an *Improvement in Machines for Making Hinges;* Edward Brown, Assignor to the Scoville Manufacturing Company, Waterbury, Connecticut.

"The nature of my invention consists in providing machinery furnished with feeding

ways, into which the skeleton hinges, previously cut out to the required form, are placed, and then introduced, one by one, by means of a feeding slide before dies, where the knuckles are turned by means of punches, and the finished hinges then ejected from the machine."

Claim.—"I claim, 1st, The slides, regulated by set screws, substantially as described. 2d, The eccentric rods sliding within the hollow rods, and connected with the slides. 3d, The sliding punches with adjusting screws, arranged as set forth. 4th, The sliding gauge with its longitudinal motion and set screws, for the purpose of securing the hinges while turning the knuckle, in the manner substantially as set forth. 5th, The fast gauge with the preventor. 6th, The slide with the catchers and the spring catchers. 7th, The gauge, in combination with the preventor, for the purpose of preventing the hinge from returning with the feeding slide; the whole being arranged and combined substantially in the manner set forth."

103. For an *Improvement in Magazine Guns;* Edmund H. Graham, now or late of Biddeford, Maine, Assignor to himself and Artemus Wheeler, Lowell, Mass.

Claim.—"I do not claim a rotary magazine connected with the barrel of a fire arm, such being in common use in repeating guns; nor to combine a magazine for powder, balls, and priming, with a hollow cylinder or tube made to encompass and revolve on a gun barrel, while the said barrel is provided with holes or passages to receive the load from the magazine, when the latter is turned round on it into a suitable position; nor the combination of a rotary charge receiver, (placed within the barrel or breech of a gun,) and a stationary loading magazine affixed on the said barrel or breech; but what I do claim is, to combine with the gun barrel and the magazine, when the latter is arranged and made to operate on the former as specified, a slide cut-off and a perforated plate, as made, applied, and operated substantially as described, the same enabling me not only to dispense with a rotary charge receiver and its attendant evils, but to retain the advantages of the arrangement of the two series of powder and ball chambers, in concentric circles on the side of the gun and out of the sight range, and to apply to the magazine and gun barrel, a contrivance which, by its peculiar operation, is rendered less or very little liable to be fouled by the smoke or any gases of the explosions of the charges."

MAY 23.

104. For an *Improvement in Constructing Ships for Safety and Escape;* Jos. Burch, Cragg Hall, near Macclesfield, England.

Claim.—"I do not confine myself to any exact form or dimensions for constructing any of the different parts; neither do I confine myself to the details herein described, so long as the peculiar character or principle of my invention be retained; but what I claim are, the several improvements, as follows: I claim the mode of constructing vessels in two distinct parts, as herein called the parent vessel and the escape vessel, on the principle and manner and for such like purposes as are described."

105. For an *Improvement in Lathes for Turning the Interior Surface of Hollow Ware;* Peter Teal and Chas. Tyler, Assignors to W. P. Cresson & Co., Philadelphia, Pa.; patented in England, April 9th, 1854.

Claim.—"We claim, 1st, The rest, with or without a friction roller attached to or combined with a swinging turning tool, so as to move therewith and bear on the surface on which the tool is operating, substantially as described, for the purpose of keeping the tool in a suitable position in relation to the surface that is being turned, and furnishing a proper seat therefor, in all its movements to follow the deviation of the motion of the surface from a true circle. 2d, Hanging the tool in a frame which is left free to vibrate, and keeping it in contact with the work by a spring, or analogous device, while the axis of the work is fixed, or has its motion limited, substantially as described, or what is equivalent, hanging or supporting the axis of the work in such a way as to allow it to vibrate freely, but keeping it in contact with the tool by a spring, or analogous device, while the tool is stationary, for the purpose of keeping the tool and work in proper contact, but allowing them to yield to any want of truth in the surface of the work, and thereby causing the tool to take about the same depth of cut on all parts of the surface."

106. For an *Improved Machine for Printing Railway and other Tickets;* Joseph Edmondson, Salford, and Caleb Haworth, Marsden, Executors of Thos. Edmondson, late of Salford, England.

Claim.—"We claim, 1st, Causing the type box to be raised and lowered to receive

the ink and print the tickets, by placing it in a swing frame, receiving motion by any means. 2d, Operating the inking roller by attaching it to a slide, which receives motion transversely to the movement of the tickets, by means of a lever operated by an eccentric, or other equivalent device, upon the main shaft of the machine. 3d, Giving rotary motion to the distributing roller, by means of a ratchet wheel, click, lever, stud, incline, and spring. 4th, The stamper or impresser bar working through the table for the purpose of pressing the ticket and the inking ribbon up to the numbering wheels. 5th, The sliding block and the machinery by which it is gradually lowered in the tube, for the purpose of keeping the tickets even, and in proper numerical order. And, lastly, the general arrangement and combination of the several parts of the machine, substantially as set forth."

107. For an *Improvement in Piano Forte Action;* Elon A. Lee, Roxbury, Mass.

Claim.—"I claim, 1st, The arrangement of the adjusting screw and button in such a manner that, instead of acting against the fixed arm of the common jack, it is brought to act on a wire or rod, or button placed in the same manner with the wire, with its button, as represented, or in any manner which is equivalent, so that as the under hammer is raised, this wire or rod by itself, or by means of its button moving in connexion with the under hammer, assists, by pressing against the button of the adjusting screw, to throw off the fly or movable arm of the jack to the recess of the under hammer, at the moment the hammer reaches the string, thus giving a free hopping motion to the hammer without diminishing the force of its blow against the string; and as the tendency of the spring is at all times to bring back the button against the wire or button, (whichever is used,) the extremity of the fly and the under hammer are kept in contact, so that the loose and uncertain movement which in trilling is often experienced in common piano fortes, is avoided. 2d, The combination of levers, connectors, and supporters, by means of which the motion is communicated from the under hammer to the hammer, in the manner represented, or in any equivalent manner, by which I am enabled to dispense with the hammer rails and back catches of common piano forte actions. 3d, The use of the movable connector with its flanch joint, in the manner represented, or in any equivalent manner, for connecting the hammer stem with the supporter, which shall allow the hammer stem, as it is moved, to be carried backward and upward, or in equivalent directions, at the same time, so that the whole course of the hammer stroke shall be nearly at right angles to the string instead of forming an arc of a circle, and producing what is called the drawing movement of common piano fortes. 4th, The connexion of the damper through the under hammer and the hammer with the opposite arms of a lever turning on a fixed fulcrum, so as to give an opposite motion to each; that is, to throw up the damper while the hammer falls, and vice versa, thus enabling me, by the forces which act at the different extremities of this lever, to put the hammer and damper in equipoise with each other, or otherwise, at pleasure, without affecting the key, so that the touch of the key may be made as delicate as desired. 5th, The arrangement of the damper and the wire or rod and the lever connecting it with the under hammer, substantially in the manner described, or in any equivalent manner, so as to dispense with all sockets for the damper wires or lifters to pass through, and also with the damper levers, damper covers, and damper buttons of common piano fortes."

108. For an *Improvement in Smut Machines;* G. B. Turner, Cuyahoga Falls, Ohio.

Claim.—"I do not claim the crimped circular scouring plates, nor any other of the described parts, separately, for they have all been previously used separately; but what I do claim is, the stationary and rotating scouring plates, inverted conical screws, and the blast spout, constructed, arranged, and operating in the manner substantially as described."

109. For an *Improved Primer for Fire-Arms;* Abner N. Newton, Richmond, Ind.

Claim.—"I am aware that a capping lever, differently constructed and arranged, but operated by the cock of the gun, has before been used, and that various devices have been employed for removing the exploded cap; such, therefore, merely of themselves, I do not claim; nor yet the rotating cap cylinder, which is an old device; but I do claim the spring forceps or capping lever, arranged and operated by the cock of the gun, in such a manner that the elastic fingers of the said lever picking a cap from the cap cylinder, or its equivalent, during each rise or back movement of the cock, convey it to the gun, or other fire arm nipple and seat, and hold it thereon, and in working back to their original position, relinquish or ease their hold laterally of the cap on the nipple, whereby

any tendency to jerk the cap off the nipple by upward movement of the capping lever is avoided, and greater pliancy and facility of adjustment is afforded in the operation of the said lever to ensure its perfect action, the said capping lever having a universal joint movement at its fulcrum, or being otherwise equivalently hung or constructed, and being operated by fixed or movable studs and springs, or the equivalent of such devices, substantially as specified. And I further claim constructing the capping lever with a crook or arm, arranged so as to gripe the nipple, and by the specified capping action of the said lever to remove the exploded cap from the nipple, preparatory to a new cap being put thereon, and simultaneously with the picking up of a cap from the cap cylinder, or its equivalent, and with the rising of the cock of the gun or fire arm, essentially as set forth."

110. For an *Improved Pump Valve;* Lewis A. Miles, Hopkinsville, Ohio.

Claim.—"I claim the valve, united by a double hinge to the chamber, in combination with the tongue, which, projecting from the pivot, bears against the top of the valve in rising, and ensures its even action upon the seat in falling, as explained, in combination or otherwise with the closing spring, as described."

111. For an *Improved Excavator for Fence Posts;* Ransom P. Adams, Clinton, Ill.

Claim.—"I claim the arrangement of the drill gearing and clutch upon and within a frame pivoted to and adjustable upon the sliding and adjustable platform, in the manner set forth. Also, making said sliding platform adjustable upon and pivoted to a fixed frame upon a traveling carriage, in the manner described."

112. For an *Improved Apparatus for the Manufacture of Daguerreotype Cases, &c.;* Frank Phoebus, City of New York.

Claim.—"We claim the arrangement of the machine for forming cushions and bands for the linings of daguerreotype and similar cases; that is to say, so combining a series of clamps with a movable block or table for holding the materials as to effect the folding of the cloth down upon the glue and the pasteboard, and the holding it there until the same is set or glued, substantially in the manner set forth."

113. For an *Improvement in Hones;* Isaac Babbitt, Roxbury, Massachusetts; patented in England, March 30, 1854.

Claim.—"I do not claim making razor straps curved in one direction, or of portions of the surface of a cylinder, as this has been done before; neither do I claim the use of metal of any description, as a material for making hones; but what I do claim is, making the grinding surface of hones for sharpening razors convex, or of portions of the surface of a sphere, in the manner described."

114. For a *Ratchet Lever;* Hiram Baldwin, Nashua, New Hampshire.

Claim.—"I claim the application of a dog and ratchet to any moving lever or wheel, in such manner that the usual application of the moving power to the lever or wheel, simultaneously lifts the tooth of the dog from the ratchet on the side to which the lever or wheel is to be moved, or the removal of that power allows it to fall back in its place, rendering the lever or wheel immovable, except in the manner described. And I claim the application of this invention not only to the moving levers of machinery generally, but as also applicable to the securing of ships' tillers or rudders, or to any other like purpose."

115. For an *Improvement in Cheese Hoops;* John Beach, De Ruyter, New York.

Claim.—"I claim the method described, of fastening and unfastening the hoop by means of the roller and hinged hasp, constructed, arranged, and operating together and in combination with the hinged halves of the hoop, for the purposes set forth, and whereby great facility and expedition is insured in the operation of the clasp, the tightening action of the clasp made effective and durable, and the hoop retained from springing or flying open when pressure is applied to the interior thereof."

116. For an *Improved Mode of Balancing Window Sashes;* Alfred J. Clarke, Lancaster, Pennsylvania.

Claim.—"I claim gearing the two sashes together in such a manner that while the balance of the sashes, the one by the other, is preserved, a differential movement is obtained for the two sashes by means of the fixed and traveling pulleys, with their cords, chains or ropes, arranged and operating together with the sashes, substantially as specified.

so that on raising the lower or one sash through a given length of space, the other or upper sash is caused to descend through a less length of space, whereby a wider opening or air space may be procured for the window at its bottom than is obtainable by the ordinary arrangement herein referred to and described, in which the sashes balancing each other are made to move with equal velocities, and the top sash thereby caused to contract or partly close the open air space at the bottom, formed by the highly raised lower sash."

117. For an *Improvement in Counterpoise to Cast Locomotive Wheels;* H. A. Chase, Boston, Massachusetts.

Claim.—"I claim the counter-balance upon the inner face of the tread of the wheel, and independent of the two side plates forming the wheel; this method allowing all the parts of the wheel to expand or contract, independent of the counter-balance, and the counter-balance itself to expand without exerting any strain on the wheel during the casting or chilling processes, as described."

118. For an *Improved Wind Mill;* James Curtis, Chicago, Illinois.

Claim.—"I claim, 1st, The so hanging of the pair or sets of sails upon one shaft extending both ways from the counter, as that when one sail of the pair turns to the wind, its fellow shall, by the partial turning of the shaft, turn edgewise to prevent resistance, substantially as described. I also claim the hanging of the said frames on hollow bearings, in combination with the sails and lines, for the purpose of reefing and furling the sails at pleasure, while the wind wheel is in motion, substantially as described."

119. For an *Improved Self-Acting Power Press;* Elias Davis, Montpelier, Vermont.

Claim.—"I claim the peculiar arrangement of the horizontal levers, vertical levers below the screw and bed plate, in combination with the manner described of constructing and operating the press, whereby an accumulative upward pressure in a straight line can be exerted upon the article being pressed, by reason of its gravity and that of the moving portion of the press, substantially as set forth."

120. For an *Improved Machine for Making Book Covers;* L. Danforth, Buffalo, N. Y.

"The nature of my invention consists in combining a pair of folders having two distinct movements, the edge of the one being the centre of motion of the other, so as to produce a perpendicular and parallel motion in quick succession, thus accomplishing at once what otherwise requires much time."

Claim.—"I claim the combination and connexion of the motions of the two folders, in such a manner that their movements may be used upon the edge of any material, such as a piece of junk, board, wood, or other substance, to fold the cloth, leather, or paper, and form a true, angular, and even edge, in the manner described."

121. For *Improvements in Hot Air Furnaces;* John P. Hayes, Philadelphia, Penna.

Claim.—"I do not claim admitting oxygen into the fire chamber for the purpose of igniting the gas or gases therein, for several plans have been devised, although not very successfully, for the same purpose; neither do I claim the rows of vertical hot air tubes, connected at their upper ends by passages or chambers; what I claim is, the general construction of the furnace, as shown and described."

122. For an *Improved Apparatus for Regulating the Supply of Feed Water to Steam Boilers;* Amos Jacobs, Ithaca, New York.

"The nature of my invention consists in regulating and indicating the height of water in steam boilers, to regulate it by means of the reservoir as a motive power, and to indicate it by the ringing or striking of the bell."

Claim.—"I claim the arrangement of the reservoir and weight, in relation to the boiler and the feed pump, substantially as described, whereby the weight of the excess water is used to regulate the supply by the pump, and to provide for its own return to the boiler."

123. For an *Improved Mechanical Means for Preventing Incrustation in Steam Boilers;* John McMullen, Baltimore, Maryland.

Claim.—"I do not claim scouring the bottom of an upright boiler by means of chains attached to arms of an upright shaft; but what I do claim is, agitating the water in steam boilers, and preventing incrustations in the same, by the action of the spirals coiled around the bars attached to the arms radiating from the shaft having an oscillatory rotary motion, and by the spirals coiled around the tubes having a longitudinal action, as described."

124. For an *Improved Machine for Sawing Thin Boards, &c.;* John Myers and Robert G. Eunson, City of New York.

Claim.—"We do not claim the adjustable and elastic roller beds, for they have been previously used; but what we claim is, 1st, The employment or use of the deflecting plates, one or both placed at the sides of the saw, as shown, for the purpose of preventing the sawed stuff from bearing against the sides of the saw, and expanding the saw kerf, and also for the purpose of allowing a thin veneer saw to be stiffened by plates, one or two, as desired. 2d, We claim the employment or use of the clamp, arranged as shown, or in an equivalent way, so as to have a lateral elastic movement, independent of the roller beds to which said clamps are attached, for the purpose of compensating for the varying thickness of different pieces of stuff, and keeping them in a proper relative position to the saw. 3d, We claim the knives or cutters, placed in the roller beds, and arranged substantially as described. 4th, We claim the employment of an adjustable bed with clamps, as described, in combination with the saw, when the saw has a stiffening plate in line with said bed, by which the stiffened or rounded side of the saw is made the 'line side.'"

125. For an *Improvement in Apparatus for Making Palliasses;* Jas. Pigot, Brooklyn, New York.

Claim.—"I claim gauging the size, stuffing, shaping, tufting, and finishing palliasses of different lengths, widths, and thicknesses, in a more perfect manner than heretofore, by the employment of a frame box or former, having one of its sides made adjustable, while its bottom and ends are adjustable and removable for the purpose of accommodating ticks of different lengths, widths, and thicknesses, and giving them the proper shape and finish; the sides of said box being set off with holes for guiding the tufting operation after the straw has been properly inserted into the tick, and the whole being constructed in the manner described."

126. For an *Improvement in Clover Harvesters;* Thomas J. Steadman, Murray, N. Y.

Claim.—"I claim, 1st, The arrangement of the cutters, in combination with the comb, operating in the manner described. 2d, The rake, in combination with the cutters, as described."

127. For an *Improvement in Processes for Treating Hemp;* Lewis C. Suggett, Lexington, Kentucky.

Claim.—"I claim, 1st, The application of common salt, or other saline substance, to the steep water, in order to enable the removal and separation of the gum, at the most advantageous condition of the lint or harl in regard to toughness and pliancy, and before the induration of the gum about the fibres, without endangering the strength of the latter by decay. 2d, The saturation of the fibre and expulsion of its moisture by immersion in boiling tar, pitch, or oil, for the purpose of more thorough and intimate application of the preserving substance to the fibres, preliminary to their immersion into twine or cordage."

128. For an *Improved Hydraulic Ram;* Joseph C. Strode, West Chester, Penna.

Claim.—"I claim, 1st, The arrangement of the tubes, in combination with the upper part of the puppet valve chamber and with the air chamber, in the manner substantially as described. 2d, The arrangement of the tubes in combination with the top of the puppet valve chamber, in the manner substantially as described."

129. For an *Improvement in Tire Bending Machinery;* R. L. Wright, Blue Rock, Pa.

Claim.—"I claim the arrangement of the adjustable spur wheel with the rising and falling roller shaft of the wheel and the concave bed, for the purpose of bending tire of variable sizes in the same machine, as set forth."

130. For an *Improvement in Locomotive Tenders;* Ross Winans and Thomas Winans, Baltimore, Maryland; ante-dated May 9th, 1854.

Claim.—"We claim the tender with an upper and lower platform, in connexion with and for the purpose of feeding with greater convenience, the furnace of a locomotive steam engine, having upper and lower feeding holes, substantially as described."

131. For an *Improvement in Button Hole Cutters;* Thomas W. Brown, Assignor to William M. Mead, Boston, Massachusetts.

Claim.—"I am aware that a button hole cutter has been made with a sliding and ad-

justable cloth rest, and a knife with a straight edge, which, when the knife was closed, was brought down upon so as to rest throughout its length on the top surface of the cloth rest; now, I do not claim such a contrivance, as my button hole cutter is constructed and operates entirely different therefrom; but what I do claim is, the combination and arrangement of the angular knife or knife edge, the cloth rest, and adjusting screw, substantially as described, and so as to operate together. And I also claim the combining a tubular cutter directly with the adjusting screw, and so that it may perform the functions of a cutter and stop."

132. For an *Improved Bracelet Clasp;* John Mansure, Assignor to Farr & Thompson, Philadelphia, Pennsylvania.

"The nature of my invention relates to the method of making and using the clasp or fastening, when applied to bracelets, armlets, or other similar articles of jewelry or toilet, and also to the device for preventing the bracelet or armlet from slipping to one side or the other, or, in other words, for holding it in the proper position."

Claim.—"I claim the forming of a clasp or fastening for bracelets or children's armlets, by means of the hinged spring arms, and the slot and ears. Also, in combination with the clasp or fastening, the strip or bar for holding the ornament in place when said strip is brought into or thrown out of action by the closing and loosening of the clasp, substantially as described."

MECHANICS, PHYSICS, AND CHEMISTRY.

For the Journal of the Franklin Institute.

Examination of the Gas of the Philadelphia Gas Works. By Chas. M. Wetherill, Ph. D., M. D.

The following examination of the Philadelphia gas was made for the engineer of the Works, Prof. J. C. Cresson, in the beginning of the year 1852, but, unfortunately, was not completed in sufficient time to be inserted in detail in his Report for that year. As the results of the examination of the gas at that time, by different operators, are at total variance, and since particular pains were taken in my examination to check its results, I have thought proper, with the permission of Prof. Cresson, to offer them in full to the criticism of the scientific public. The analysis was performed with the apparatus of Bunsen, which I made and graduated with care; and following Bunsen's process and precautions, as detailed in the *Hand woerter-Book de Chemie*, vol. ii., p. 1050.* The course of analysis and calculation is as follows:

The gas was tested for carbonic acid and sulphuretted hydrogen by passing through lime water and solution of acetate of lead, (in one instance a direct examination for CO_2, by measurement, was made), of which being found absent, it was dried in the small eudiometer by a chloride of calcium ball, and measured.

The olefiant gas and hydro-carbon vapors were absorbed by a coke ball saturated with a mixture of anhydrous and concentrated sulphuric acid, followed by a ball of oxide of manganese and one of caustic potassa.

Oxygen was absorbed by a phosphorous ball by aid of heat followed by a caustic potassa ball.

The residual gases supposed to consist of nitrogen, light carburetted hydrogen, carbonic oxide, and hydrogen, were transferred to the large

* I discovered a typographical error in one of the equations in this article; on page 1066, the equation $\frac{1}{2}x + \frac{1}{2}y + 2z = B$, should be $\frac{1}{2}x + 2y + \frac{1}{2}z = B$.

eudiometer mixed with a known quantity of oxygen, and the absorption noted after explosion. The resulting carbonic acid having been determined by a potassa ball, the unconsumed oxygen was ascertained by exploding with a known quantity of hydrogen, and the nitrogen obtained by subtracting this oxygen from the volume left as above, by the absorption of carbonic acid.

Calling $x =$ hydrogen,

$y =$ light carburetted hydrogen,

$z =$ carbonic oxide,

$A =$ the sum of combustible gases,

$B =$ the oxygen used for their combustion,

$C =$ the carbonic acid formed, we have, according to Bunsen's formulæ,

$$x = A - C,$$

$$y = \frac{2B - A}{3},$$

$$z = C - \frac{(2B - A)}{3}.$$

On measuring the above results, the temperature was ascertained by an accurate Centigrade thermometer by Greiner, which indicated half degrees. The mercury column in the eudiometer was subtracted from the barometric pressure, which was determined by an excellent Gay Lussac barometer, of Lerehours and Secretan, and the hydroscopic state of the gas also noted. The volumes were then reduced to 0° Centigrade, and 1000 millimetres pressure, *dry*, by the formula.

$\log r' = \log. r + \log. (B - b - T) - \log. [1000 + \log. (1 + d t^\circ)]$ in which

$r =$ measured volume,

$r' =$ corrected volume,

$B =$ barometric pressure,

$b =$ mercury column in eudiometer,

$T =$ tension of aqueous vapors at temperature t°, and

$d = 0{\cdot}003665$.

The volume per centage was the calculated

Experiment A.—*Gas collected in a Sealed Tube at my Laboratory*, 206 *Cherry Street, Jan.* 26*th*, 1852, 11¼ *A. M., letting Gas run for a quarter of an hour before Sealing.*

	r	t°	B m. m.	b mer. col. in eudiomer.	r' Vol. at 0°, and 1000° m. m.
1. Original vol. (*moist*,)	119·0	13°	758·8	67	77·32
2. After absorp. by potassa (*dry*),	118·0	15°	759·6	68	77·35
3. Olefiant gas absorbed "	109·2	14°	759·7	76	71·01
4. Oxygen absorbed by phos. "	110·4	19°	762·6	75	70·97

The rest of the analysis lost in the subsequent explosions.

Jan. 27th.—Gas passed through a solution of acetate of lead for 10 minutes; no precipitate; absence of sulphuretted hydrogen.

Passed through lime water for half an hour, keeping a similar test-tube with lime water alongside for comparison; no carbonic acid could be detected.

B.—Gas collected for analysis, Feb. 5th, at $1\frac{1}{2}$ P. M., same locality. Passed, before collecting, through solution of acetate of lead and lime-water for 10 minutes; no precipitate suffered to escape for 10 minutes before sealing its tube.

	r	t°	B. m. m.	b	r' corrected volume.
1. Gas dried in eudiometer by Ca. Cl. ball (dry,)	95·4	17°	754·3	91·2	59·556
2. Olefiant gas absorbed (dry,)	87·0	18°	763·0	98·5	54·234
3. Oxygen absorbed (dry,)	86·0	16°	766·6	100·0	54·153
4. Transferred to large eudiometer (moist,) .	130·8	13°	769·2	379·0	47·332
5. After admission of oxygen (moist,) . .	316·9	15°	768·0	189·0	170·110
6. Explosion (moist,)	210·5	16°	767·0	296·0	90·971
7. Carbonic acid absorbed (dry,) . . .	165·5	16°	768·9	342·5	66·661
8. Hydrogen added (dry,)	456·6	16°	766·3	50·5	308·73
9. Explosion (moist,)	238·1	16°	765·8	268·5	108·82

Checks upon calculations.

1st.—$n +$ combustible gases $= 47{\cdot}332$.

$$\begin{aligned} x &= 22{\cdot}991 \\ y &= 21{\cdot}665 \\ z &= 2{\cdot}645 \\ n &= 0{\cdot}031 \\ \hline & 47{\cdot}332 \text{ same as above.} \end{aligned}$$

2d.—Let
$$\left.\begin{aligned} v &= \text{combustible gases} = 47{\cdot}301 \\ a &= \text{oxygen consumed} = 56{\cdot}148 \end{aligned}\right\} = 103{\cdot}449$$
$$\left.\begin{aligned} m &= \text{the absorption} \quad 79{\cdot}139 \\ n &= \text{the carb. acid found} \quad 24{\cdot}310 \end{aligned}\right\} = 103{\cdot}449$$
$$v + a = m + n.$$

B, *Second Analysis to Check First Analysis.*

	V	t°	B	b	r'
1. Dried ore, Ca. Cl. .	101·8	16°	760·9	83·0	65·189
2. Olefiant gas, &c., absorbed,	94·5	16°	756·9	91·0	59·307
3. Oxygen absorbed, .	94·5	16°	754·5	91·0	59·229

The rest of the analysis lost in the explosion. The walls of the eudiometer were taken of thin glass of the size that Bunsen suggests, but being made of flint glass, and having once injured myself by a breakage of similar glass, I made the several explosions with great circumspection, endeavoring to increase the elasticity by not pressing the tube too hard upon the caoutchouc, by which, in the experiments lost, some of the gases were forced out of the eudiometer.

Feb. 11th, 20 minutes before 11. Same locality. Gas reacted alkaline to litmus paper. Passed for 10 minutes through a solution of nitrate of silver, the solution became yellowish, with a slight whitish precipitate, which, on applying heat to the test tube, became reduced to black silver, acquiring metallic lustre under the burnisher.

During the above analysis, the gas-metre at my laboratory was filled with spirits on account of the cold weather; the gas therefore contained a small proportion of alcohol vapors.

The errors of observation and manipulation I believe to be within $\frac{1}{10}$th of one per cent.

The following table shows the per centage volume of gases, according to my analysis:

Per centage by Volume, Gases dry, at 0° *Centigrade, and* 1000 *Millimetres Barometer.*

	A	B 1	B 2
Carbonic acid,	00·000		
Olefiant gas and hydro-carbon vapors,	8·157	8·963	9·023
Oxygen,	0·052	0·136	0·120
Hydrogen,		44·168	
Light carburetted hydrogen,		41·620	
Carbonic oxide,		5·081	
Nitrogen,		0·059	
		100·000	

With regard to the small amount of nitrogen, I would call attention to the fact that Bunsen and Playfair have shown the quantity of nitrogen in gas from coal to be exceedingly small in quantity ; their results gave a per centage of 0·01 of this gas.

It was intended that I should have instituted comparative analyses of Philadelphia and New York gas, for which purpose there were given me three sealed tubes, one of Philadelphia gas, the other two from N. York. On examining the sealed ends of these tubes with a microscope, very small holes were noticed in two of them, rendering an analysis useless, since diffusion must have taken place; the remaining tube was so thin at its closed end that the warmth of the hand in examining it exploded the tube.

The following are the results obtained by Professors Booth and Faber, Stewart and Alexander, of which the full details are not given. The first two chemists performed their analysis according to Bunsen's process, using an accurate German thermometer, and a French aneroid barometer, indicating, according to a comparison with an ordinary mercurial barometer, 0·01 of an inch ; their report is dated Dec. 30th, 1851.

Profs. Alexander and Stewart examined New York gas (from the Manhattan Company,) collected in the New York Hotel, in the forenoon of Jan. 2d, 1852, and Philadelphia gas collected by Prof. Booth from a burner in his laboratory, in the forenoon of Jan. 1st, 1852. The hydrocarbons were absorbed by chlorine water in the dark, and which, the analysts say, appear slightly in excess from the vapor of naphtha accompanying the potassium used as one of the re-agents. The following table of direct measurements, corrected for 30 inches barometer, and 32° Fahr., is given in Profs. Stewart and Alexander's report :

	Manhattan gas.	Philada. gas.
Carbonic Acid,	0·0222	0·0087
Hydro-carbons,	0·0928	0·0996
Olefiant gas,	0·0344	0·0204
Light carburetted hydrogen,	8·7089	0·3227
Hydrogen,		0·4049
Nitrogen,	0·1231	0·1461
	0·9814	1·0024

The gas volumes of these different chemists are reduced to 32° Fahr., and barometric pressure 30 inches, (about 762 millimetres.)

Volume Per centage.

	Profs. Booth and Faber.		Profs. Alexander and Stewart.	
	N. York Gas.	Philada. Gas.	Manhattan Gas.	Philadelphia Gas.
Olefiant gas,	8·32	6·38	3·50 } 12·95	2·04 } 11·17
Hydro-carbon,			9·45 }	9·93 }
Marsh gas,	32·92	54·84	*32·04	32·20
Hydrogen,	24·04	26·27	*40·20	40·39
Carbonic oxide,	11·60	4·42		
Carbonic acid,	2·10	0·97	2·27	0·87
Oxygen,	0·19	0·04		
Nitrogen,	20·83	7·08	12·54	14·57
	100·00	100·00	100·00	100.00

* Not separated experimentally, but their proportions calculated in the same ratio as in the Philadelphia gas.

As will be seen by a comparison of these results with each other, and with my own, there is no agreement at all between them. Perhaps a publication of the details of the above-mentioned analyses would bring order out of apparent confusion. It is always well to publish details, for not only do they afford sometimes the only means of criticism, but are useful in preserving records of analyses from being lost, when from some newly observed fact a recalculation from the original data is necessary.

For the Journal of the Franklin Institute.

Computed Table of Draft of Flues. By Prof. John C. Cresson.

Having occasion, recently, to prepare a tabulated statement of the effective power of vertical flues under the influence of various conditions of temperature, I have thought it might be made useful to others by publication in the *Journal*, and therefore offer it as a small contribution to the much neglected arts of warming and ventilation.

The numbers at the head of each column represent the temperature, in degrees of Fahrenheit, of the air within the flue; and those in the first column on the left, that of the air outside.

The calculations are made according to the following commonly received formulæ for the expansion, equilibrium, and flow of æriform bodies.

1st. Gay Lussac's law showing their increase of volume to be $\frac{375}{1000}$ or $\frac{3}{8}$ in passing from freezing to boiling points of water with equal increments of volume for equal additions of thermometric heat.

2d. Fluid columns are in equilibrium when their heights are inversely as their densities, or, in case of homogeneous gases, directly as their relative expansion by heat; and this difference of height, or, when heights are equal, their reciprocal densities constitute the effective head creating the draft of flues.

3d. By Torricelli's formula, the velocity of flow under the ascertained head is $V = \sqrt{2\,g\,H}$, and the coefficient of actual discharge is assumed

as that for a thin plate, which well represents an ordinary damper or flue register, $Q = 0{\cdot}625\ A\ V$, or $\frac{5}{8}$ths the theoretical discharge.

The numbers in the body of the table show the quantity of air in cubic feet per minute that will be drawn through a register, or other similar opening one foot square, by a vertical flue of 100 feet effective height at the given temperatures.

To adapt these numbers to flues of different heights, multiply them by one-tenth the square root of the effective height in feet.

It is to be understood that the area of cross-section of the flue is not less than that of all the openings for which the flow is computed; otherwise the computations must be based on its area instead of theirs.

Fahr.	60°	80°	100°	120°	150°	200°	250°	300°	450°
0°	1020	1167	1281	1380	1500	1665	1796	1896	2124
10°	940	1092	1215	1320	1450	1622	1760	1866	2100
20°	840	1010	1145	1256	1395	1580	1725	1833	2075
32°	705	904	1046	1181	1342	1530	1675	1795	2045
40°	594	826	995	1125	1285	1490	1645	1765	2027
50°	426	723	904	1054	1225	1441	1606	1758	2002
60°	0	581	810	975	1163	1394	1566	1697	1980
70°	/	415	699	892	1095	1342	1525	1661	1950
80°	/	0	575	798	1025	1291	1480	1625	1925
90°	/	/	415	688	950	1238	1436	1590	1900
100°	/	/	0	562	866	1178	1391	1550	1874

The small table appended below gives the proper factors to be applied as above, for flues less than 100 feet high:

Height of Flue.	Factor.
10 feet.	0·316
20 "	0·447
30 "	0·547
40 "	0·632
50 "	0·7
60 "	0·774
70 "	0·836
80 "	0·894
90 "	0·948

On the Spheroidal State of Bodies. By Arthur H. Church, Esq. *To Dr. Tyndall, F.R.S. &c.**

The successful method by which, in your last lecture, the existence of a space between water in the spheroidal state and the containing vessel was proved by the complete interruption that space offered to the passage of a galvanic current, has induced me to devise a few experiments on the subject.

I have to describe in the present communication, in the first place, some experiments I have just performed for the purpose of obtaining decisive evidence of the isolation of all bodies in the spheroidal state from the surfaces on which they roll; and in the second place, to offer a few suggestions as to the probable causes of the phenomena under consideration.

*From the Lond., Edinb., and Dubl. Philosoph. Magazine, April, 1854.

It was found by Boutigny, that if into a clean, red-hot platinum capsule acids and alkalies be placed, the acid and alkaline liquids will roll about, repelling one another violently. This, though an interesting example of the suspension of chemical affinity, does not prove the existence of a space between the platinum vessel and the spheroids.

The first experiment I have to mention was this:—I took a copper basin, three inches in diameter and rather more than half an inch deep, polished its concave surface, and covered it with a thin film of silver by the galvanic process. The plated basin was now brought to a very high temperature, and while thus heated, a few drops of a slightly alkaline solution of sulphide of sodium were poured into it. These drops instantly assumed the spheroidal form and rolled about, making, however, no mark or track upon the silver. The source of heat was now withdrawn: the temperature was soon so far reduced that the liquid exhibited its normal properties, the space between it and the silver no longer existed, and a black stain of sulphide of silver covered the dish.

Another instance of the assumption of the spheroidal state has been often noticed. It occurs when ether is placed on the surface of boiling water. Now, if a fixed inorganic acid be dissolved in ether, and the water be colored with litmus, no reddening of the latter will take place as long as the ether remains in the spheroidal state. The acidulated ether and the tinted water cannot, therefore, be in communication; they are separated by a film of air or of vapor.

I pass on to notice in as few words as possible the remainder of my experiments. I have remarked that in certain circumstances spheroidal globules form upon the surface of liquids during the processes of filtration and distillation. The phenomenon to which I refer is exhibited by many liquids, more frequently and conspicuously perhaps by those that are the more volatile. I have observed it with alcohol, water, aqueous and alcoholic solutions, syrup, with essential oils and many other organic substances. I have sometimes, however, found considerable difficulty in its reproduction, and will therefore describe in detail a method which is applicable in most cases for obtaining in this manner an example of the spheroidal state. We will employ a particular instance. If we take cymole, a hydrocarbon belonging to the benzole series, and half fill a bottle two or more inches in diameter with it, placing in the neck of the bottle a perforated cork through which passes a funnel-tube filled with cymole, and having a piece of sheet India-rubber stretched over its mouth, we shall find that on adjusting the funnel-tube till its lower extremity is rather less than half an inch from the surface of the liquid in the bottle, and on letting fall a drop of cymole from it, beautiful spheroidal globules will be formed and roll about for some time, scarcely diminishing in size. This experiment may be performed with great advantage if the cymole be warmed first. An ordinary funnel with a filter may be substituted for the funnel-tube, and will answer well if the lower aperture of the funnel has a diameter of about ·13 of an inch. The experiment may be repeated with other materials with similar effects. That the spheroids are not in contact with the surfaces on which they roll, may be proved by saturating the liquid in the tube with something that shall have a visible effect upon a substance dissolved in the liquid

in the bottle. A beautiful illustration of this occurs when, under conditions similar to those before mentioned, we employ in the funnel-tube a solution of sugar containing sulphocyanide of potassium, and in the bottle a solution of sugar containing sesquichloride of iron; no red coloration takes place until the coalescence of the spheroids with the liquid beneath them. Many other chemical reactions may be made use of with similar results. It is very curious to see a solution of ferrocyanide of potassium floating upon a solution of sesquichloride of iron, while not a trace of Prussian blue is formed. These experiments must of course be recommenced whenever any union of the liquids employed has taken place. The cork spoken of above should have two perforations, one to admit the funnel-tube, and the other to allow the escape of air.

Is the employment of a volatile substance essential to the production of these phenomena? I imagined that this question might be answered by the following experiment. A dish of platinum might be heated strongly, and a drop of melted lead then placed upon it; now if the production of vapor from the substances employed were essential to the formation of the spheroidal state, the lead should at once dissolve and perforate the platinum; if, however, the spheroidal state occurs when two non-volatile substances are employed, the platinum vessel should not be perforated until its temperature has been considerably reduced. The experiment was tried with every precaution to prevent the oxidation of the lead and insure an accurate result; a perforation of the platinum ensued the moment of placing the melted lead upon it. This proves that the production of vapor is essential to the occurrence of the spheroidal state; for it cannot be urged that that condition is never manifested when metals only are employed; for a drop of a volatile metal, mercury (melted mercury, we may say, in order to render its relationship to melted lead the more apparent), placed on an intensely heated surface of platinum instantly assumes the spheroidal form, and evaporating slowly, dances about in the vessel with peculiar movements. Upon thin, sonorous vessels of copper, &c., this movement takes place with such rapidity as to produce a musical tone of high pitch. I have sometimes seen globules of mercury and water rise to the height of six inches from the capsules in which they had been formed.

A word or two in conclusion, as an attempt at an explanation of the phenomena observed may not be out of place.

Since a space always exists between the lower body and that in the spheroidal state, and since that state is not manifested by non-volatile substances, it seems reasonable to conclude that the vapor proceeding from those parts of the liquids nearest to the containing vessel or subjacent fluid tends to assist the internal molecular cohesive force of the drops in assuming and maintaining their spheroidal form. Other forces originated by the temperature may also be in operation.

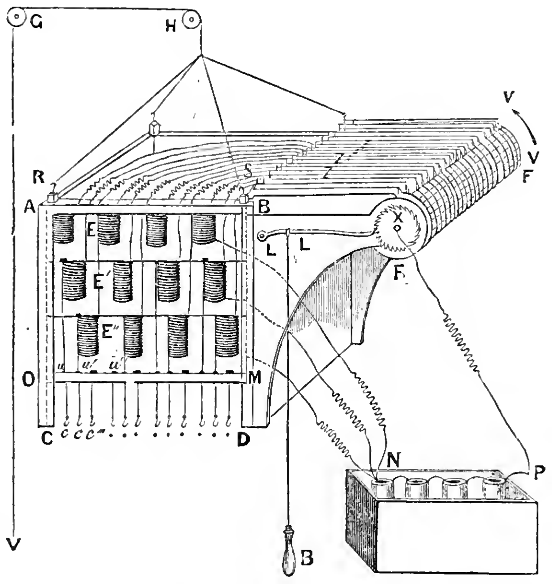
I should premise that the solution of sulphide of sodium employed in my first experiment made a dark stain upon silver even in the cold. This renders the nullity of its action at a high temperature the more remarkable. It will be scarcely necessary to mention, that, for the successful performance of most of these experiments, considerable manipulative care is required.—*Royal College of Chemistry, March* 18, 1854.

For the Journal of the Franklin Institute.

Description of the Electro-Magnetic Loom.

A great deal of attention has been recently paid in France to a proposed modification of the Jacquard loom, in which, by means of the introduction of electro-magnetism, the working of the machine is said to have been rendered much less costly. Considerable acrimony has been shown in a controversy between M. Bonelli, the original inventor, and M. Maumenè and others, who have endeavored to improve upon the original idea, while it was still undergoing improvement at the hands of its deviser. With all this we have nothing to do, but take, for the benefit of our own mechanics, the following description of the apparatus. Nothing doubting that if they find the idea as practically useful as it certainly is ingenious, they will very soon do all that is necessary to replace the old method by the new one.

Fig. 1.



A, B, C, D, the frame containing the electro-magnets E, E′, E″; c, c', c'', the hooks for raising the threads of the warp, supported by the heads, u, u', u'', upon the movable platform, O, M. V, the treadle-rod and strap passing over the pulleys, G and H, and holding the platform, O, M, by the cords, R, S. F, F, the cylinder, the axis of which, X, is connected with the pole, P, of the battery. L, L, the ratchet and wheel, by means of which, when worked by the handle, B, the cylinder is allowed to move one tooth in the direction indicated by the arrow, V, V. Z, Z′, the bent wires or teeth, through which the electric current is conducted from the different compartments of the cylinder, to the corresponding electric magnets.

The idea of M. Bonelli may be explained by the accompanying figure and brief description. The hooks which raise the threads of the warp to allow the shuttle to pass under them, are terminated above by iron heads, and are lifted by bars which rise and fall under a frame which contains

the electro-magnets, of which one corresponds to every hook, and is so placed that when the hook is raised by its bar, its iron head is brought in contact with the face of the magnet. The bar which raises the hooks is itself raised by working the treadle of the loom, by the alternate motion of which it is lifted and lowered, carrying the hooks with it in its upward movement, and suffering them to fall again when it descends, unless they, or some of them, are retained by the attraction of their corresponding magnets. If, then, it is desired that any thread of the warp shall be passed over the filling, the galvanic current from a battery must be passed around the magnet corresponding to that hook of the warp, which will be held until the rest descend, and will keep its thread in the required position to allow the shuttle to pass under it. In order to adjust the contacts so that at each blow of the shuttle, the currents shall pass through the proper magnets, and through them only, a metallic cylinder is prepared, the axis of which is connected with one pole of the battery. Above this cylinder are placed, side by side, a series of metallic wires or strips placed edgewise, bent at one end so as to rest with a slight spring upon the cylinder, while the other end of each strip is connected with the wire of one of the magnets; the other ends of all the magnetic wires are connected together, and lead to the other pole of the battery. It is evident, now, that if the battery be put in action, the current will pass through the cylinder, will then divide, passing through each wire, rendering the iron bar around which it is wound, magnetic, and will then re-unite by the union of the wires, and return to the battery by the opposite pole. But if, now, a drop of varnish, or of any other non-conductor of electricity, be put upon the cylinder, as it passes under one of the wires the current through that wire will be stopped, and its iron core will cease to be magnetic. If then a pattern of any kind be drawn with varnish upon the cylinder, a number of the wires will be thus affected, while others will be left free to pass their currents. Now, whenever the treadle carries up the hooks previous to each blow of the shuttle, those hooks corresponding to the magnets which are in action, (that is, those through which the circuit is passing,) will be retained, and the shuttle must pass under their threads, while those hooks which correspond to magnets not in action, that is, to those whose wires are resting at that moment on the varnish, will drop as the treadle returns, and the shuttle will pass over their thread. The cylinder being, by appropriate mechanism, moved forward after each blow of the shuttle, a new line of the pattern comes under the ends of the wires, and thus other threads are kept up, and the pattern thus worked out upon the stuff.

The principal advantage which is to be gained by this ingenious modification is, in the suppression of the cards, which, in the Jacquard loom, as it now exists, govern the positions of the threads, and are sometimes very costly. (It is said that a set of cards for some of the French shawl patterns cost as much as $5000.)

The objections made to it are, first, its greater expense, the magnets costing perhaps $1·00 apiece, which, in a loom of 500 or 1000 hooks, will add very greatly to the first cost of the machine. It must not be forgotten, however, that this is only a first cost, and that once established the loom is permanent, and when the pattern is done with, it may be

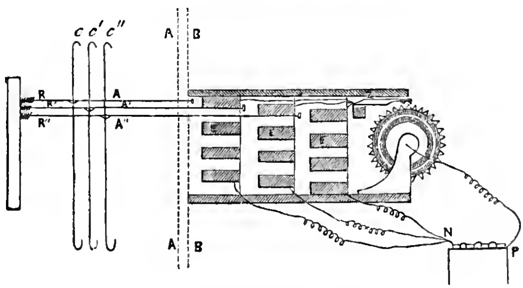
washed off of the cylinder with alcohol or other solvent, and replaced by a new one.

The second objection made to the loom of M. Bonelli is, that it increases the labor of the workman, or if the loom be driven by mechanical power, the force necessary to drive it. For, whereas, in the loom as now constructed, the workman has not, on an average, to raise more than half of the hooks, and the weights necessary to bring them down again; in the new arrangement, the whole of the hooks and weights have to be raised at every blow of the treadle, and at least one-half of them on an average, uselessly, since they return with the sinking of the rod. The battery, too, will require considerable power to hold such a number of weights, and it may be questioned whether the magnetic attraction is sufficient to retain the hooks with certainty against the jars to which all working apparatus is subject; for it must be remembered that the slightest separation of the iron from the polar face of the magnet, weakens the attraction almost indefinitely.

It appears also to be a matter of question among practical weavers, whether a non-conducting varnish can be found sufficiently strong to resist the rubbing of the end of the wires over it, for, should the varnish wear off, the current will pass, and the pattern in the stuff will be defective. Again, although the Jacquard cards are expensive, yet when a pattern is in great demand, and it is desirable to set a number of looms at work upon it at once, the pattern cards are easily and rapidly copied, and the new looms can be set at work without any great additional expense. Can the same be done with the Bonelli loom? M. Maumenè thinks not, and perhaps he is right, although we think that these last two objections will not be found very serious in practice. It appears to us easy to copy the original pattern by transfer, and then the filling up with varnish may be rapidly done, and by a common workman, and upon any number of cylinders, while the original design by the artist is kept.

To remedy these real or supposed objections to M. Bonelli's loom, M. Maumenè, a Professor in the City of Rheims, where the business of weaving employs a large capital and great number of workmen, proposes the following modifications:

Fig. 2.



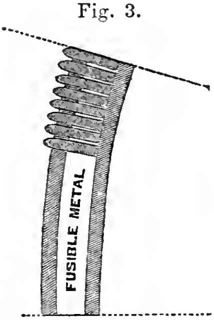
E, E′, E″, the electro-magnets in their frame. A, A, position of the front of the magnet-frame when advanced. B, B, its position when withdrawn. A, A′, A″, the needles which are operated on by the magnets. C, C′, C″, the hooks which raise the warp. R, R′, R″, elastic springs of the needles. P, N, the battery.

The frame of magnets is laid, as it were, upon its side, and is moved

horizontally by a spring to and from the upright beam, through which pass the horizontal needles, corresponding to the hooks of the warp. This motion is controlled by the treadle, and is arranged so that the frame brings the magnets into contact with the needle-heads, and then moves them back again just before the shuttle passes. If the magnets are in action, the needles are retained and drawn aside by them; if they are not in action, the needles are kept in their places by a spiral spring wound around one end of them. The needles which are drawn aside permit the corresponding hooks to rise; those which remain in place prevent theirs from doing so. By this means the labor is reduced, as in the Jacquard loom, to the lifting of only a certain number of hooks and weights, in place of all of them; the magnets have no longer to exert a powerful attraction to counteract the jar of the loom, but may be made weaker and smaller, and will thus cost less, and occupy less room.

In place of the metallic cylinder of M. Bonelli, with its pattern drawn in varnish, M. Maumenè proposes to substitute one made of sheet brass, perforated with holes punched close to each other, and in straight lines, (a sufficiently stiff wire gauze would probably answer;) over this is stretched a piece of paper thin enough to allow the holes to be seen through it, upon which paper the pattern is drawn. This cylinder is supported around another of a diameter small enough to allow a space of a quarter of an inch between them. The pattern-maker then proceeds to mark out the pattern by driving pins which pass through the holes of the outer cylinder, and rest upon the inner, their length being such that they will project, say, $\frac{1}{10}$th of an inch above the outside cylinder. When the pattern is completed, the pins are secured by pouring fusible metal (which melts in boiling water) between the two cylinders; it will be kept from passing out through the holes in the outer cylinder by the paper which surrounds it, and as it cools, will fix the pins firmly in their places. This cylinder now being substituted for that of M. Bonelli's, under the comb of wires which lead from the magnets, the current will pass whenever a tooth touches one of the pins, while if no pins intervene, the end of the tooth will pass without touching the cylinder itself, and will thus interrupt the appropriate currents. M. Maumenè thinks that the pattern can be worked out on his cylinder much more rapidly and cheaply than on that of M. Bonelli, and that a fault in design may be more easily and speedily repaired by cutting off any superfluous pin, or by heating the end of a new one, when one is to be supplied, and driving it into the proper hole. He proposes to copy patterns by making a plaster mould from the original, and taking fusible metal casts from this mould. When a pattern is done with, the cylinder has only to be laid in boiling water, and in a few minutes the paper is washed away, the fusible alloy melted, and the pins loosened, so that the

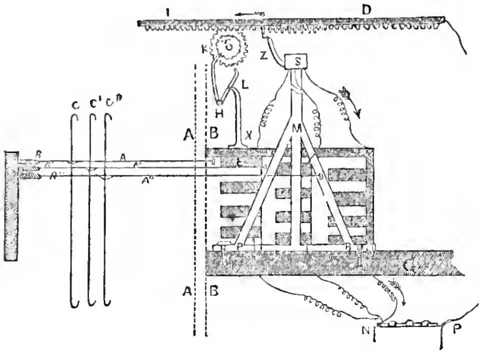
Fig. 3.



Enlarged View.

cylinder being washed and dried, is ready for use again for another pattern.

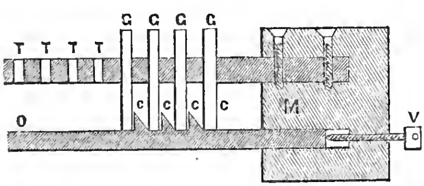
Fig. 4.



A, A, and B, B, are as before the two positions of the magnet frames, E, E′. Z, the teeth or conducting wires, supported on the separate frame, S, M, R. I, D, the plate which takes the place of the cylinder of the first system. K, O, H, L, X, the ratchet system by which each forward and back motion of the magnet frame moves the plate forward one tooth in the direction on the arrow. A, A′, A″, the needles. R, R′, R″, their springs. C, C′, C″, the hooks.

Finally, to gain still further in economy of expense and facility of handling and working the patterns, M. Maumenè proposes to use plane sheets in place of cylinders, which move in horizontal grooves above the loom. They are to be prepared by laying two plates, $\frac{1}{4}$-inch apart, the upper one of which is pierced with holes, as before, and the under one transversely ribbed or fluted. The pattern is marked, as before, by pins dropped through the upper, and resting on the lower plate, which is at first so placed as to allow the pins to drop into the flutings (between the ribs.) The pins are then secured by giving to the lower plate a small longitudinal motion, so as to press the ribs against the pins. Such an apparatus, M. Maumenè believes, secures the minimum of expense and trouble, and the maximum of rapidity and security for the work.

Fig. 5.



Enlarged view of M. Maumenè's plate, showing its construction.—M, one of the blocks into which are grooved the ends of the upper and lower plates. T, T, the perforations of the upper plates. G, G, the pins, fitting as exactly as possible into the holes. O, the lower plate, with its ribs, C, C, C, and movable for a short distance, longitudinally, by the screw, V.

We do not pretend to express any judgment between the rival claimants, but recommend to our own weavers what appears to us to be an idea full of ingenuity, and of practical availability.

Translated for the Journal of the Franklin Institute.

Note on the difference of Temperature between the Surface of the Earth, and the Air in contact with it. By M. Rozet.

It is known that the surface of the earth is more heated under the influence of the rays of the sun, than the air in contact with it. In 1830 I found that in the neighborhood of Algiers, the temperature of the sand on the sea shore sometimes exceeded that of the air by 30° (Cent.)

In 1850 I began a series of observations at Orange, at 46 metres above the level of the sea, with two thermometers, one suspended in the shade at 1 metre above the earth, the other at a depth of 0·01 m. (0·4 inch,) below the surface, and covered with earth.

In 1851 I continued these observations at Gap, at 750 metres above the sea, during the months of May, June, and July, and I have just renewed them at Tours, at 90 metres above the ocean, during the fine weather of the first half of March. The following are the results obtained: all soils do not heat in the same way, but the law of the variation of the differences of temperature from the air is constant, and the same for all. On a fine day, the sky without clouds, at sunrise, no difference exists; the excess of temperature of the soil over that of the air increases very regularly until about 2 hs. 30 m. of the afternoon; it then gradually diminishes in the same way, until an hour after sunset, when the difference disappears, and thus it remains until sunrise again. Only four times during all the course of my experiments have I found the temperature of the soil at sunrise lower by 1° or 2° than that of the air. At sunset the difference is already only 1·5°, or even 0·5°, so that, generally, the loss of temperature by the surface of the soil to a depth of 0·01 m., does not exceed these quantities. The maximum differences were in March, 9°, in May, 11·5°, in June, 14°, and in July, 14°.

Laying off on a horizontal line from left to right, equal spaces to represent times from sunrise, and raising at every point an ordinate proportioned to the difference of temperature at that time, we get, on clear days, a regular curve, whose horizontal tangent corresponds to 2 hs. 30 m., while the curve bends much more rapidly on the right hand than on the left of that point. After one hour after sunset the curve generally coincides with the axis of abscissas; very rarely does it pass below it; it is true, however, that I have made no observations in winter.

On days when the sky is covered the form of the curve remains the same; but it rises much less above the axis of abscissas. On such days the maximum differences varied in May, from 2° to 4°, in June, from 4° to 6·5°, and in July, from 4° to 7°.

In clear weather, if a cloud covers the sun for 30 minutes only, the difference of the two temperatures evidently decreases, then augments again so soon as the sun re-appears; so that for every such alteration, the curve has a point of contrary flexure.

Several times, when the sun showed himself after a rain, I have found the temperature of the moist ground lower than that of the air, or the difference negative; but if the sun continued to shine, it soon became positive, and the point of flexure was then below the axis of abscissas.

I made some observations during my geodetic stations on the summits of the Alps, and I have ascertained that in the month of June, at 2200 metres of altitude, the difference between the temperature of the soil and that of the air, in fine weather, reached 10°.

My employment not permitting me to follow these observations strictly, I communicate to the Academy the results of those which I have made, to induce meteorologists to resume them, and continue them with more care and regularity than I have done."—*Comptes Rendus de l'Academie des Sciences, (Paris,)* 3d April, 1854.

For the Journal of the Franklin Institute.

Application of Branch Currents to the Electrical Telegraph. By M. Petrina, of Prague.

M. Petrina has been employed for eighteen months in constructing break-circuit apparatus for the current, like those which are used in electrical induction-machines. One of these apparatus by its rapid vibrations produced very distinct tones, and gave him the idea of making an electrical harmonica, with a collection of interrupters. He thought at first, that to play on his harmonica he would be obliged to use as many small batteries as he had tones, as he was convinced that otherwise the current by division would become too enfeebled, and that each apparatus would in consequence not give the tone which was expected from it. The experiment, however, showed him that he was mistaken: with a single element for the eight interrupters of his harmonica, he observed neither weakening of the current nor change of tone; and he could, without any difficulty whatever, sound his eight vibrating springs, either together or combined in any way whatever. It could not be otherwise, for the fact demonstrated by the experiment is a necessary consequence of Ohm's theory and of the laws of branch currents. In fact, according to the theory of Ohm, the current of a galvanic apparatus increases in proportion to the diminution of the sum of the resistances to the current; and the law of branch currents requires that each one of the currents shall have the same intensity which it would have if the circuit was closed by that conductor only, admitting, however, that the resistance of the electro-motor is very small or sensibly null, not only in regard to the sum of the resistances of all the circuits, but also in regard to the resistance of each closed conducting circuit.

M. Petrina is astonished that the important theory of branch currents has been, at least to his knowledge, no where applied to the electric telegraph. In the central office at Vienna, there are as many principal batteries as there are telegraphic lines leaving that office, and as many local batteries as there are Morse's recording apparatus. Whilst according to what we have said, a single principal, and a single local battery would suffice, even while messages were being sent along all the lines at once. The only condition to be complied with would be, that the single battery should be strong enough to transmit the signals to the most distant stations; one of its poles would be united with the wires of all the lines, the other pole would, as usual, go to the ground.

Let us designate, by F, the electro-motive force of the pile; by R_1 R_2 R_3, the respective resistances of the different lines; by I_1 I_2 I_3, the intensities of the currents for each closed circuit; we will have, according to Ohm's law, $I_1 = \frac{F}{R_1}$. $I_2 = \frac{F}{R_2}$. $I_3 = \frac{F}{R_3}$.

Since, by hypothesis, the resistance of the battery is infinitely small, in comparison with the resistance of the circuit, and it may be neglected. If the pile is at work at all the stations at the same time, we shall have (calling R the sum of all the resistances, and I the intensity of the current then generated) $I = \frac{F}{R}$; (supposing always that the resistance of the battery may be neglected,) we have, moreover, as every one knows,

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \&c.$$

and, consequently, $R = \frac{R_1\ R_2\ R_3}{R_2\ R_3 + R_1\ R_3 + R_1\ R_2}$.

$$I = \frac{F\,(R_2\ R_3 + R_1\ R_3 + R_1\ R_2)}{R_1\ R_2\ R_3} = \frac{F}{R_1} + \frac{F}{R_2} + \frac{F}{R_3} = I_1 + I_2 + I_3.$$

This last equation shows clearly, that when the pile serves all the lines, its natural intensity is the sum of all the intensities of the different circuits separately closed, and as, besides, each branch-current is as intense as it would be if the battery were closed, by its conductor alone, it follows that the branch currents are independent of each other, and exercise no influence on each other, whether they are exerted simultaneously, or one after the other.

What we have just said, evidently applies to the local batteries, and nothing prevents the same battery from working any number of writing apparatus at once. The only practical objection which can be made against the application of the theory is, that the branch-currents of the nearest stations would be too strong for a regular service. M. Petrina answers, 1st, that every good telegraphic apparatus must be able to work with currents of very different intensities; and, 2d, that means are not wanting, to reduce, at pleasure, a current which is too strong. One very simple and appropriate means of doing this is as follows: If the telegraphic lines from the same office are of very different lengths, the battery of the farthest station only will be kept, and the extremities of the other stations will be fixed according to the order of their lengths and the strength of current necessary, so as to use in the circuits, the currents of 12, 18, 14, 30 elements of the battery of the distant station, we can thus take from the one principal battery the elements necessary to constitute the local batteries.

The above discussion is extracted from the *Comptes Rendus of the Sessions of the Imperial Academy of Sciences of Vienna, for* 1853, tom. x, p. 3 et seg. We find, at the bottom of p. 6, the following note: His Excellency, the President of the Academy, remarked that the experiments made at the central office at Vienna, completely confirmed the theoretic ideas which had led M. Petrina to affirm that the number of batteries might be considerably diminished. In this way the number of elements

has been reduced at Vienna, from 480 to 84; at Verona from 180 to 60; at Trieste from 150 to 84; at Salzburg from 180 to 60; at Oderberg from 96 to 36. In place of 1102 elements formerly employed at all the stations, only 324 are now used. This is, as will be seen, a considerable progress, and the example of Vienna deserves to be followed everywhere. We have heard it vaguely rumored that at the central telegraph office of Paris but one battery was used for the whole of the lines.

In another note inserted in the July number of the *Compt. Rend. of the Imper. Acad. of Vienna*, p. 375, M. Petrina indicates another new mode of simplifying telegraphic correspondence at great distances. Four successive stations, A, B, C, and D, are connected together in the order of the letters, and it is required to correspond with D. In the received arrangement, the current goes from A to B; at B it simply brings into action another battery called the "relay," and goes to the ground. The current coming from A must have a certain intensity which we will designate by I; calling R the sum of the resistances between A and B; F the electro-motive force necessary to generate the current to overcome them, we shall have $I=\frac{F}{R}$. Supposing that the relay at C has the same sensitiveness as that at B, the station B must send to C a current of the same intensity I, and if we designate by R, the total resistance between B and C, and by F' the corresponding electro-motive force, we must have, again, $I=\frac{F'}{R'}$; and, finally, in the same way for the station C; $I=\frac{F''}{R''}$. Let us now conceive that the relay apparatus at B and C are suppressed, and that the batteries placed at A, B, and C, are united through telegraphic wires by their poles of contrary names, so as to constitute but one pile; then in this pile the electro-motive forces F F' and F'' will be in action at once, and since the sum of the resistances between A and D is $R+R'+R''$, (if we subtract the resistance of the relay apparatus which has been removed,) we shall have for the intensity of the current given by this compound pile, $I'=\frac{F+F'+F''}{R+R'+R''}$.

On the other hand, we deduce from the three equations already established, $I\,R=F$. $I\,R'=F'$. $IR''=F''$), $I\,(R\times R'\times R'')=F+F'+F''$: $I=\frac{F\times F'\times F''}{R\times R'+R''}$; consequently, $I=I'$.

Thus, in the two arrangements adopted, whether each battery works separately, or the three piles are united so as to work as one pile, the effect produced is the same. But as uniting the batteries together, the resistance of the relay apparatus is suppressed, (a resistance which M. Petrina has shown to be equal to from 14 to 18 leagues for each one of them, according to the size of the conducting wire of the line,) it is evident that I' will always be greater than I, and that by adopting the second arrangement, force will be saved, and more in proportion as the line is longer, to the extent of suppressing one battery in every three.

The experiments of M. Petrina prove, first, that so far as the intensity of the current is contained, it is indifferent whether we accumulate all

the resistances outside of the battery, between the two poles, or distribute them by equal or unequal parts between the elements of the pile, as it were in its interior. Secondly, that telegraphic signals are transmitted perfectly and without any disturbance or irregularity through the circuit of a battery thus divided. Thirdly, that the signals may leave any point in the circuit, and may be received at any other point. Fourth, that with the same current by which a telegraphic signal is sent from A towards D, a signal may be sent from D towards A, there being no necessity for placing in the circuit a battery at D. Fifth, that if we unite into one, several powerful batteries, each one of which, by its total resistance, gives a current of the intensity, i, the one compound battery will produce a current of the intensity, i, admitting that the sum of the resistances of the partial batteries remains the same.

To avoid the objection which might be made to him that he had not verified the results of his theory on sufficiently long telegraph lines, M. Petrina, by introducing between the batteries with which he was working, voltameters filled with water, more or less conducting, made artificial circuits whose resistance was equal to that of a telegraphic conductor of 200 leagues in length. Sustained by this verification, he thus concludes: "Since the modification which I suggest, gives more surety in the transmission of signals, spares force, and consequently expense, requires no new arrangement nor addition in existing apparatus, I have every reason to hope that it will be adopted, and that the relays, which are not only useless, but hurtful, since they create a resistance without any good effect, and which may, moreover, be utilized by employing them as relays for the printing apparatus to be introduced into the line, may be suppressed."—*Cosmos*, vol. iv., p. 352.

Remarks.—We translate the above extract, because it contains the theory of what has been practised in this country for many years on our telegraph lines, and because it serves to show, how very superior we are here in our practical application of scientific discoveries.

Both the discoveries of M. Petrina, viz: the working of several telegraphic circuits by the same battery, and the union of the batteries of different stations by connecting their opposite poles, have been in use in this country upon the Morse lines, since 1847 and 1848, at least. See "*Vail's Description of the Electro-Magnetic Telegraph*," 1847: pp. 24 & 45. It is evident, however, that Mr. Vail did not know that he got the full effect of the battery over each circuit. The testimony given in the celebrated case, French et al. *vs.* Rogers, in which the whole subject of electric telegraphing was thoroughly discussed, shows that the use of a portion of the main battery to work the registering circuit, as well as the combination of all the batteries at various stations into one, was well known to the practical telegraphic operator here. See *Complainant's Testimony*, p. 104, and "Plate IV, facing p. 68." As to the lines thus worked, it is in daily use from Philadelphia to Pittsburgh, (300 miles,) and it has at times been done from Philadelphia to Cincinnati. One great practical advantage, and perhaps the greatest, has been entirely overlooked by M. Petrina and his commentators. It is the more equal distribution of the electrical intensity throughout the circuit, and the consequent preservation of better insulation along the line. For i

100 cups be required to work the telegraph from Philadelphia to Pittsburgh, and the battery be all at Philadelphia, the intensity of the current near the battery renders it liable to overcome the resistance in a damp part and return to the negative ground-plate by a short circuit. But if the battery be distributed, 25 cups at Philadelphia, 25 at Pittsburgh, and 25 at each of two intermediate stations, then the tendency of escape at any point of the line is reduced to one-fourth, and the same insulation is four times better (roughly speaking) for this current than for the former.

We recommend these facts to Paris and Vienna, and advise them to make themselves familiar with the practical knowledge which the telegraph operators in this country possess.—Ed.

For the Journal of the Franklin Institute.

The Transatlantic Steamship Herman. By B. F. Isherwood, Chief Eng. U. S. Navy.

The *Herman* is one of the line of steamships plying between the cities of New York and Bremen, touching at Cowes and Southampton. Her total cost was $324,000, including machinery. She was constructed at New York by Westervelt and Mackay; launched September, 1847, and completed March, 1848. The machinery was furnished by the Novelty Works, of New York, and cost $152,000. The following are the dimensions of the hull, machinery, &c.:—

Hull.

Length on spar deck,		241 feet.
Length on water line at $19\frac{1}{3}$ feet draft,		235 "
Breadth extreme,		40 "
Depth of hold,		31 "
Depth of keel and false keel below planking,		16 inches.
Deep load draft, leaving port,		21 "
Light " entering "		17 " 9 inches.
Mean draft with half coal out,		19 " 4 "
Displacement at $19\frac{1}{3}$ feet draft,		2645 tons.
Displacement per inch of draft at $19\frac{1}{3}$ feet draft,		17·4 "
Displacement at $19\frac{1}{3}$ feet draft, in proportion to circumscribing parallelopipedon,	0·546	
Displacement at $19\frac{1}{3}$ feet draft, in proportion to cylinder, having for base the area of the greatest immersed transverse section,	0·600	
Area of the water line at $19\frac{1}{3}$ feet draft,		7294 square feet.
Area of the water line at $19\frac{1}{3}$ feet draft, in proportion to circumscribing parallelogram,	0·776	
Greatest immersed transverse section at $19\frac{1}{3}$ feet draft,		655 square feet.
Area of greatest immersed tranverse section at $19\frac{1}{3}$ feet draft, in proportion to circumscribing parallelogram,	0·909	
Angle of entrance of the water line at 20 feet draft,	51°	
" " " " 10 " "	36°	
" clearance " " 20 " "	62°	
" " " " 10 " "	25°	
Angle of dead rise of the greatest immersed transverse section,	8°	
Launching draft of the hull with 53 tons of kentledge on board,		10 feet 8 inches.
Displacement per inch of draft at $15\frac{3}{4}$ feet draft,		15·833 tons.

Weights Carried.

Machinery, exclusive of water in boilers,	450 tons.
Water in first set of boilers,	120 "
Coal bunkers, iron diagonal braces for hull, fastenings, &c.,	25 "
Joiner work throughout for passenger accommodations, boiler deck, masts and spars, &c.,	50 "
Rigging, chains, anchors, &c.,	30 "
Ballast,	73 "
Coal carried,	867 "
Weight of hull,	1050 "
Weight of freight and passengers, with effects, &c.,	328 "
Corresponding to a draft of water of 21 *feet,*	2993 tons.

Engines.—Two side lever, condensing engines; the cylinder valves are of the balance poppet kind, cutting off the steam by Stillman & Allen's adjustable arrangement.

Diameter of cylinders,	72 inches.
Stroke of pistons,	10 feet.
Space displacement of both pistons per stroke,	565·48 cubic feet.
Steam space comprised at *one* end of *both* cylinders, between the pistons and cut-off valves,	22 "

First Paddle Wheels, (*used on the* 12*th and* 13*th Voyages*).—Of the common radial kind; each paddle was in two pieces of equal width, 18 inches each, one piece on the front and the other on the back of the arm.

Diameter from outside to outside of paddles,		36 feet.
Length of each paddle,		8 "
Width of each paddle,		36 inches.
Area of two paddles,		48 square feet.
Immersion of the lower edge of the paddle at $19\frac{1}{3}$ ft. draft,		7 feet 1 inch.
Number of paddles in one wheel,	28	
Number of paddles in one wheel in the water, at $19\frac{1}{3}$ feet draft,	7	
Total immersed area of paddle surface at $19\frac{1}{3}$ feet draft,		336 square feet.
Distance traversed per revolution of the wheel by the centre of pressure of the paddles,		106·8 feet.
Oblique action of the paddles with an immersion of 7 feet 1 inch, in per centums of the power applied,		20·17

Last Paddle Wheels, (*used on the* 14*th,* 15*th,* 16*th, and* 17*th Voyages*).—Of the common radial kind; each paddle was in a single piece.

Diameter from outside to outside of paddles,		36 feet.
Length of each paddle,		8 "
Width of each paddle,		26 inches.
Area of two paddles,		$34\frac{2}{3}$ square feet.
Immersion of the lower edge of the paddles at $19\frac{1}{3}$ ft. draft,		7 feet 1 inch.
Number of paddles in one wheel,	28	
Number of paddles in one wheel in the water at $19\frac{1}{3}$ feet draft,	7	
Total immersed area of paddle surface at $19\frac{1}{3}$ feet draft,		$242\frac{2}{3}$ square feet.
Distance traversed per revolution of the wheel by the centre of pressure of the paddles,		108·4 feet.
Oblique action of the paddles with an immersion of 7 feet 1 inch, in per centums of the power applied,		20·17

First Boilers, used on the 12*th and* 13*th Voyages.*—Two in number, of iron, placed side by side, with one smoke chimney in common. The heating surface is arranged in single return ascending flues. For each boiler the lower or direct flues are 24 feet 5 inches in length, and con-

sist of fourteen 10 inches diameter, two of 18 inches diameter, and two of 24 inches diameter; the upper or return flues are 28 feet 10 inches in length, and consist of six 18 inches in diameter. That portion of the shell of the boiler containing the flues is circular, 28 feet long, and 12½ feet diameter. The furnaces are, for each boiler, three in number, 7 feet long; the side furnaces are 58 inches broad, and the centre furnace 41 inches broad.

Length of each boiler, . . .	36 feet.
Breadth " " at furnaces, . .	15 " 1 inch.
Height " " " . .	13 " 10 "
Area of the total heating surface in the two boilers,	5944 square feet.
" " grate " " " .	183 " "
Aggregate cross area of lower or direct flues in the two boilers,	34·91 " "
" " " upper or return " " "	21·21 " "
Cross area of the smoke chimney, . .	27·27 " "
Height of the smoke chimney above the grates,	75 feet.
Distance traversed by the heated gases from the centre of the furnaces to their delivery into the chimney, .	62·33 feet.

Proportions.

Proportion of heating to grate surface, .	————
" grate surface to cross area of lower or direct flues,	32·48 to 1·00
" " " " upper or return "	5·24 "
" " " " smoke chimney,	8·63 "
Square feet of heating surface per cubic foot of space displacement of pistons per stroke, . .	10·5114 "
Square feet of grate surface per cubic foot of space displacement of pistons per stroke, . .	0·3236 "

Last Boilers, (*used on the* 14*th*, 15*th*, 16*th*, *and* 17*th Voyages.*)—Four in number, of iron, placed in pairs back to back, with two smoke chimneys, one to each pair of boilers. The heating surface is arranged in horizontal tubes returned above the furnaces. Each boiler contains 199 tubes of 3¼ inches outside, and 3 inches inside diameter; they are all 9 feet 10 inches long, and contain 1664·94 square feet of surface. The entire shell of the boiler is circular. There are three furnaces in each boiler 6½ feet long; the side furnaces are 3¼ feet broad, and the centre furnace 4¼ feet broad.

Length of each boiler, . . .	14 feet.
Diameter " " . .	12 " 6 inches.
Area of the total heating surface in the four boilers,	8352 square feet.
" " " grate " " "	279·5 " "
Aggregate cross area of the tubes, . .	39 " "
" " " " smoke chimneys,	47·5
Height of the smoke chimney above the grates, .	75 feet.
Distance traversed by the heated gases from the centre of the furnaces to their delivery into the chimney, . .	23·58 feet.

Proportions.

Proportion of heating to grate surface, . .	29·88 to 1·00
" " grate surface to cross area of tubes,	7·17 "
" " " " " smoke chimneys,	5·88 "
Square feet of heating surface per cubic foot of space displacement of pistons per stroke, .	14·7698
Square feet of grate surface per cubic foot of space displacement of pistons per stroke, . .	0·4943

Steam Logs.—I have been kindly furnished by Mr. L. S. Bartholomew, with the steam logs of the *Herman*, for the voyages during which he was

Chief Engineer of her. These logs, which were very carefully kept, I have arranged in order, and compiled from them a summary which presents the general results in connexion. They are particularly valuable as showing the different effects produced with the same vessel and engines, by different boilers, paddle wheels, and fuel, the data being the result of a sufficiently extended course of steaming to entitle the means of so many observations to very great confidence. The indicator diagrams, of course, furnish with great certainty the points of cutting off, the difference between the boiler and initial cylinder pressure, and the mean effective pressure throughout the stroke. The temperature of the hot well was kept very regularly at 120° Fahr., by a thermometer. The throttle throughout was carried wide open. The vacuum in the condenser averaged 25 inches of mercury. With the first boilers, which were used on the 12th and 13th voyages, the fuel was burned with a strong artificial blast, produced by centrifugal fans driven by small steam cylinders. These boilers burned Pennsylvania anthracite on the easterly, and Welsh anthracite on the westerly voyages. The last boilers used the natural draft only, and burned Cumberland bituminous coal on the easterly, and Welsh anthracite on the westerly voyages. By anthracite I mean coal containing 85 per centum, and over, of fixed carbon. The last boilers were used on the 14th, 15th, 16th, and 17th voyages. The length of the geographical mile is taken from Frome at 6115·8 feet on the 45th parallel of latitude. The fuel was accurately measured out in tubs, and the average weight of a tub full was ascertained for each cargo of coal. On the westerly voyages the bunkers were filled full at Bremen, and again at Southampton. The number of revolutions made by the wheels was ascertained by a counter, and the distances run each day were determined by observation. The initial cylinder pressure was very regularly 3 lbs. per square inch less than the boiler pressure.

Weather.—An inspection of the steam logs shows that the best weather was experienced in the month of April, and that it became gradually worse with each succeeding month up to October, which is so far as the logs relate.

Of the six voyages made from New York to Bremen, being passages from west to east, occupying in the aggregate, 2354 hours 27 minutes, 1256 hours 56 minutes, or 53·39 per centum, was performed under steam and sail, leaving 1097 hours 31 minutes, or 46·61 per centum, performed under steam alone.

Of the six voyages made from Bremen to New York, being passages from east to west, occupying in the aggregate, 2544 hours 43 minutes, 689 hours 54 minutes, or 27·11 per centum, was performed under steam and sail, leaving 1855 hours 49 minutes, or 72·89 per centum, performed under steam alone.

From the above it appears that sail was carried for twice the time on the eastward voyages that it was carried on the westward voyages.

Expenditure of Stores.—The principal engineer's stores used in addition to the fuel were, oil, tallow, and wiping stuff. Of these, the average expenditure for 24 hours was as follows, viz: oil, 4 gallons 1 pint; tallow, 3 lbs.; wiping stuff, $5\frac{1}{2}$ lbs.

SUMMARY OF THE STEAM LOGS.

		TOTALS.						MEANS.						CALCULATED.		
Number of Voyage.	DATE.		Duration of the voyage in hours and minutes.	Number of hours under steam alone.	Number of hours under steam and sail.	Double st'kes of engines' pistons, as ascertained by a counter.	Length of the voyage in geographical miles of 6115·8 feet, by observation.	Consumption of coal in tons of 2240 lbs.	Double st'kes of engines' pistons made per min.	Speed of the vessel per hour in geographical miles of 6115·8 feet.	Steam pressure in the boilers in pounds per square inch above atmosphere.	Where the steam is cut off at from commencement of stroke of pistons in feet.	Consumption of coal per hour in pounds.	Slip of the centre of pressure of the paddles in pr cents. of their speed.	Mean effective pressure throughout stroke in pounds per square inch of pistons.	Horses power developed by the engines.
	From New York to Bremen, with Pennsylvania Anthracite, first Boilers and first Paddle Wheels.															
12th,	June and July,	1850.	392 16	78 23	313 53	234550	3592	659·143	9·966	9·157	11·7	5·00	3764	12·31	15·9	782
13th,	August and September,	"	388 34	155 34	233 00	237934	3611	663·428	10·206	9·314	12·2	5·00	3825	12·90	16·3	821
	Means,		390 25	116 59	273 26	236242	3601	661·286	10·086	9·236	11·9	5·00	3794	12·60	16·0	796
	From Bremen to New York, with Welsh Anthracite, first Boilers and first Paddle Wheels.															
*12th.	July and August,	1850.	412 21	336 38	75 43	235800	3442	628·165	9·530	8·347	10·9	5·335	3412	16·41	15·7	738
13th.	September and October,	"	492 29	353 57	138 32	264705	3596	775·277	8·958	7·302	11·2	5·333	3526	22·20	16·0	707
	Means,		452 25	345 18	107 7	250253	3519	701·721	9·219	7·778	11·1	5·334	3474	19·48	15·9	723
	From New York to Bremen, with Cumberland Bituminous Coal, last Boilers and last Paddle Wheels.															
14th.	March and April,	1851.	407 9	202 24	204 45	242693	3643	563·535	9·935	8·948	11·8	3·537	3104	15·31	13·1	642
15th.	May and June,	"	396 47	250 38	146 9	239725	3648	597·000	10·070	9·194	11·2	3·529	3370	14·15	12·7	631
16th.	July,	"	368 35	88 19	280 16	232511	3635	556·578	10·514	9·862	10·9	3·500	3383	11·95	12·3	638
17th.	September,	"	401 6	322 13	78 53	252880	3693	654·970	10·508	9·207	12·4	3·500	3658	17·61	13·5	700
	Means,	.	393 24	215 54	177 31	241952	3655	593·021	10·250	9·290	11·6	3·517	2376	14·78	13·0	658
	From Bremen to New York, with Welsh Anthracite, last Boilers and last Paddle Wheels.															
14th.	April and May,	1851.	395 47	237 24	158 23	251168	3664	591·000	10·577	9·258	13·0	3·775	3345	17·69	14 5	757
15th.	June and July,	"	386 23	224 40	162 19	246888	3596	570·690	10·650	9·307	13·5	4·083	3309	17·82	15·5	815
16th.	August,	"	434 8	360 18	73 50	261242	3636	704·035	10·029	8·376	13·1	3 671	3633	21·47	14·2	703
17th.	October,	"	423 35	342 28	81 7	257292	3600	674·800	10·124	8·499	14·3	4·114	3569	21·60	16·4	819
	Means,		409 58	291 12	118 56	254148	3624	635·131	10·326	8·840	13·5	3·908	3470	19·50	15·3	780

* Exclusive of the performance with one engine only, during July 21 and 22, while the other engine was being repaired.

For the Journal of the Franklin Institute.

Observations on a Telegraph Line between Europe and America.

By L. Turnbull, M. D.

The magnificent idea of connecting Great Britain and the United States by telegraph, which has long been a favorite one with me, has been again revived in this country, and received much strength and encouragement from the investigations of the depths and condition of the bottom of the ocean, along the route of the merchantmen between Europe and the United States. According to a recent letter of Lieut. Maury's to the Secretary of the Navy, dated February 22, 1854, Lieut. Berryman availed himself of this opportunity to carry a line of deep-sea soundings from the shores of Newfoundland to those of the Irish coast.

The result is highly interesting, as it bears directly, in so far as the bottom of the sea is concerned, upon the question of a submarine telegraph across the Atlantic, and I therefore beg leave to make it the subject of a special report.

This line of deep-sea soundings seems to be decisive of the question as to the practicability of a submarine telegraph between the two continents, *in so far as the bottom of the sea is concerned.*

From Newfoundland to Ireland, the distance between the nearest point is about 1600 miles;* and the bottom of the sea between the two places is a plateau, which seems to have been placed there especially for the purpose of holding the wires of a submarine telegraph, and of keeping them out of harm's way. It is neither too deep nor too shallow; yet it is so deep that the wires, but once laid, will remain forever beyond the reach of vessels' anchors, icebergs, and drifts of any kind; and so shallow that the wires may by readily lodged upon the bottom.

The depth of this plateau is quite regular, gradually increasing from the shores of Newfoundland to the depth of from 1500 to 2000 fathoms, as you approach the other side.

The distance between Ireland and Cape St Charles, or Cape St. Lewis, in Labrador, is somewhat less than the distance from any point of Ireland to the nearest point of Newfoundland.

But whether it would be better to lead the wires from Newfoundland or Labrador, is not now the question; nor do I pretend to consider the question as to the possibility of finding a time calm enough, the sea smooth enough, a wire long enough, a ship big enough, to lay a coil of wire 1000 miles in length; though I have no fear but that the enterprise and ingenuity of the age, whenever called on with these problems, will be ready with satisfactory and practical solutions of them.

I simply address myself at this time to the question in so far as the *bottom of the sea* is concerned, and as far as that, the greatest practical difficulties will, I apprehend, be found after reaching soundings at either end of the line, and not in the deep-sea.

I submit herewith, a chart showing the depth of the Atlantic according to the deep-sea soundings, made from time to time, on board of vessels of the navy, by authority of the Department, and according to instructions issued by the chief of the Bureau of Ordnance and Hydrography. This chart is plate XIV. of the sixth edition of Maury's Sailing Directions.

By an examination of it, it will be perceived, that we have acquired by these simple means a pretty good idea as to the depression below the sea-level of that portion of the solid crust of our planet which underlies the Atlantic Ocean, and constitutes the basin that holds its waters.

A wire laid across from either of the above named places on this side, will pass to the north of the Grand Banks, and rest on that beautiful plateau to which I have alluded, and where the waters of the sea appear to be as quiet and as completely at rest, as it is at the bottom of a mill-pond.

It is proper that the reasons should be stated for the inference that there are no per-

* From Cape Freels, Newfoundland, to Erris Head, Ireland, the distance is 1611 miles; from Cape Charles, or Cape St. Lewis, Labrador, to ditto, the distance is 1601 miles.

ceptible currents, and no abrading agents at work at the bottom of the sea upon this telegraphic plateau.

I derive this inference from a study of physical fact, which I little deemed, when I sought it, had any such bearings.

It is unnecessary to speak on this occasion of the germs which physical facts, even apparently, the most trifling, are often found to contain.

Lieut. Berryman brought up with Brook's deep-sea sounding apparatus, specimens of the bottom from this plateau.

I sent them to Prof. Baily, of West Point, for examination under his microscope. This he kindly gave, and that eminent microscopist was quite as much surprised to find, as I was to learn, that all these specimens of deep-sea soundings are filled with microscopic shells; to use his own words, "*not a particle of sand or gravel exists in them.*"

These little shells, therefore, suggest the fact that there are no currents at the bottom of the sea whence they came—that Brook's lead found them where they were deposited in their burial place after they had lived and died on the surface, and by gradually sinking were lodged on the bottom.

Had there been currents at the bottom, these would have swept and abraded and mingled with these microscopic remains, the debris of the bottom of the sea, such as oaze, sand, gravel and other matter; but not a particle of sand or gravel was found among them. Hence the inference that these depths of the sea are not disturbed either by waves or currents.

Consequently, a telegraphic wire once laid there, there it would remain, as completely beyond the reach of accident, as it would be if buried in air-tight cases. Therefore, so far as the bottom of the deep-sea between Newfoundland, or the North Cape, at the mouth of the St. Lawrence, and Ireland, is concerned, the practicability of a submarine telegraph across the Atlantic is proved.

The present state of Europe invests the subject of a line of telegraph wires across the Atlantic with a high degree of interest to the government and people of the United States. A general European war seems now almost inevitable; the attitude which this government will assume with regard to all the belligerent powers that may be involved in that war, is that of strict, impartial neutrality.

The better to enable this government to maintain that position, and the people of the United States to avail themselves of all the advantages of such a position, a line of daily telegraph communication with Europe would be of incalculable service.

In this view of the subject, and for the purpose of hastening the completion of such a line, I take the liberty of suggesting for your consideration the propriety of an offer from the proper source, of a prize, to the company through whose telegraphic wire the first message shall be passed across the Atlantic.

From the above interesting and instructive letter, the following points are to be decided by the telegraphic engineer:—

1st. "To find a time calm enough, and a sea smooth enough to lay down a telegraphic cable." In my own mind, this first difficulty can be overcome as easily as the observations of Lieut. Berryman were made, if times of calm are found for such careful observations as he has made, by means of a twine string so as to let down a cannon ball of sixty-four pounds, and then raise a tube filled with the shells and earth of the depths of the ocean, we are almost certain, a time calm enough, and a smooth sea, can be found to stretch a wire cable from land to land.

The second difficulty is, "a wire long enough." On this point we have accurate data to follow. The cable from Calais to Dover, is 24 miles long, and consists of four copper wires, through which the electric currents pass, insulated by coverings of gutta percha. These are formed into a strand, and bound round with spun-yarn, forming a core or centre, around which are laid ten iron galvanized wires of $\frac{5}{16}$ths of an inch in diameter, each welded into one length of $24\frac{1}{2}$ miles and weighing about 15 tons per mile. The rope weighs altogether about 180 tons. It formed a coil of 30 feet diameter outside, 15 feet inside, and five feet high, and was

made in the short space of 20 days, by a machine invented by Mr. George Fenwick, an engineer of the Leaham Harbor Iron Works, in Durham.

The transatlantic cable, if the machinery is multiplied, and sixteen machines are employed, could, we have little doubt, complete the cable in six or seven months.

The third difficulty is, "a ship big enough." This can be no difficulty, for if one would not do, surely twenty would. What is the objection to sending it by trips or in pieces? Could it not be attached, as it was laid down, to a *buoy*. A vessel of 1000 tons could surely carry 400 tons of coil, for our cable would not exceed 12,000 tons.

Another important matter to be determined is, to what extent a galvanic current can be sent on an insulated wire. This has also been determined, for in favorable states of the atmosphere, lines in this country have been so insulated as to work in one circuit from 800 to 1000 miles.

In my work on the Telegraph, p. 152, I there state, that the greatest distance that any of the lines had worked in one circuit, was from Boston to Montreal, via New York, Buffalo, and Toronto; a distance of about 1500 miles. This was done when the earth was frozen and the lines insulated by frost.

The entire length of the telegraph line from New York to New Orleans, via Charleston, Savannah, and Mobile, is 1966 miles, and even this distance has been worked as one circuit by the aid of an instrument termed a connector, the effect of which is to cause one circuit to work the other through the entire series, thus producing a result similar to working through the entire line in one circuit.

As late as December 3, 1853, despatches were written direct through from New Orleans to Philadelphia and New York, on the National Telegraph line, the weather being cold and the earth frozen. In doing so the only connector or repeater used was an insulated screw on the back of the register, invented by a distinguished telegraphic engineer, W. C. McRea, of this city, which is now the simplest mode employed; but this distance would require at least 30 Grove's cups, of a pint each, for every 100 miles, making about 480 cups; or 240 each side. I think this number of the battery of Mr. C. T. Chester,* would be amply sufficient. If a copper and zinc battery were employed, the number would have to be increased to about 30 to 40 cups every hundred miles, but even with this large battery, the expenses would be less than with the Grove's battery. In preparing the batteries, it is even possible to determine mathematically beforehand the amount of resistance and the force necessary to overcome it; and thus to proportion the number and size of the plates to the distance to which the wires extend. Large wires are better conductors than small ones. Copper is a much better conductor than iron; and as a thinner wire answers the purpose of conduction, it may be much more easily insulated.

The several conditions may all be calculated from the beautiful formula of Ohm.

In some recent experiments of Professor Faraday, that distinguished philosopher, by some of the results he obtained, has thrown much light

* For description of this form of Battery, see p. 65.

upon the action of voltaic electricity in the submerged wire of the electric telegraph.

He first determines by actual experiment, that when copper wire is perfectly covered with gutta percha, so high is the insulation that in 100 miles of such wire when fully charged by an intensity battery of 350 pairs of plates and submerged in water, the deflexion of a delicate galvanometer was not more than 5°. The great perfection in the covering of the wire may be judged of by this fact alone. The 100 miles of wire was $\frac{1}{16}$th of an inch in diameter; the covered wire was $\frac{4}{16}$ths; the gutta percha on the metal was considered as 0·1 of an inch in thickness. There could not be any better proof than this, that gutta percha is one of the best insulating agents we have, which fact I have before stated in my work on the Telegraph. He experimented with the subterraneous wires, which exist between London and Manchester, and when they were all connected together so as to make one series, they made almost the distance as determined by Lieutenants Berryman and Maury between the Irish coast and Newfoundland, being 1500 miles, and having introduced galvanometers at intervals of about 400 miles, he found that when the whole 1500 miles were included, it required *two seconds* for the electric stream to reach the last instrument, which was placed at the end. In this instance the insulation was not as perfect, still the result shows that it will require a little over two seconds to cross the Atlantic by telegraph, which is about the rate of 750 miles in a second, which result is far below those obtained by the London and Brussels telegraph, which is stated at only 2700 miles in a second, even with a copper wire, while it will be remembered that Wheatstone, in 1834, with copper wire, made the velocity of the electric current 288,000 miles per second, a considerable difference.

The whole of this difference, according to Professor Faraday, depends upon the lateral induction of the wire carrying the current. "The production of a polarized state of the particles of neighboring matters by an excited body, constitutes *induction*, and this arises from its action upon the particles in immediate contact with it, which again act upon those contiguous to them, and thus the forces are transferred to a distance. If the induction remain undiminished, then perfect insulation is the consequence; and the higher the polarized condition which the particles can acquire or maintain, the higher is the intensity which may be given to the acting forces. In a word, insulators may be said to be bodies whose particles can retain the polarized state; whilst conductors are those whose particles cannot be permanently polarized." And in regard to long circuits, such as those described, their conducting power cannot be understood, whilst no reference is made to their lateral static induction or to the conditions of intensity and quantity which then comes into play.

The conducting power of the air and water wires are alike for a constant current. This, according to Faraday, is in perfect accordance with the principles and with the definite character of the electric force, whether in the static, or current, or transition state. When a voltaic current of a certain intensity is sent into a long water wire, connected at the further extremity with the earth, part of the force is in the first instance

occupied in raising a lateral induction round the wire, ultimately equal in intensity at the near end, to the intensity of the battery stream, and decreasing gradually to the earth end.

In the report of Professor Faraday, which is given in the *Lon. Phil. Mag.* for March, he there in conclusion refers to the terms *intensity* and *quantity.* These terms, he remarks, or equivalents for them, cannot be dispensed with by those who study both the static and dynamic relations of electricity. Every current where there is resistance, has the static element and induction involved in it, whilst every case of insulation has more or less of the dynamic element and conduction; and we have seen that the same voltaic source, the same current in the same length of the same wire, gives a different result, as the intensity is made to vary with variations of the induction around the wire. The idea of intensity, or the power of overcoming resistance, is as necessary to that of electricity, either static or current, as the idea of pressure is to steam in a boiler, or to air passing through apertures or tubes; and we must have language competent to express these conditions and these ideas.

In conclusion, I trust that a cable may be laid across the briny deep, and I am happy to find the matter taken hold of by intelligent and scientific telegraphic engineers, and its completion will be one of the wonders of the age. I have been recently informed that a company has been organized, styled the New York, Newfoundland, and London Telegraph Company, whose object is the establishment of a sub-marine telegraph, to connect Newfoundland with Ireland. Peter Cooper, Esq. a telegraph-wire merchant of New York, is the President, and Prof. S. F. B. Morse, is the Vice President, with a number of Directors. One of the most active is Tal. P. Shaffner, Esq., a gentleman who has had considerable experience in submarine telegraph lines during the past five years, and who employed the following language in regard to the enterprise in the first number of a Journal of which he is editor. "Tides may ebb and flow; the billows may surge with mighty power; the icebergs may tower their white mantled forms high in the skies, and sink deep in the briny sea; the heavens may let loose the loud rolling thunder, and the earth heave up its fiery lava; but just as sure as these elements of nature exist, and worlds revolve, America and Europe will be connected by an electric cord."

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, June 15, 1854.

Owen Evans, Esq., President, pro tem., in the chair.

John P. Parke, Esq., Recording Secretary, pro tem.

The minutes of the last meeting were read and approved.

A letter was read from Edward Cheshire, Esq., Assistant Secretary of the Institute of Actuaries, London.

Donations to the Library were received from The Royal Geographical Society; The Royal Institute of British Architects; The Institute of

Actuaries, and Edward Cheshire, Esq., of London; The National Observatory, Washington, D. C.; W. Milnor Roberts, Esq., Marion, Ohio; East Tennessee and Georgia Railroad Co., Athens, Tenn.; J. Smith Homans, Esq., City of New York; Major Hartman Bache, U. S. Top. Engineers; The Councils of the City of Philadelphia; The Academy of Natural Sciences; Edward Miller, Esq.; Professor John F. Frazer; and John W. Nystrom, Esq., of Philadelphia.

The Periodicals received in exchange for the Journal of the Institute were laid on the table.

The Treasurer's statement of the receipts and payments for May was read.

The Board of Managers and Standing Committees reported their minutes.

New candidate for membership in the Institute (1) was proposed, and the candidates (3) proposed at the last meeting were duly elected.

Dr. Rand, Chairman Com. Meet., exhibited several forms of apparatus for cooking and heating by gas. Among them was the *Atmopyre*, a gas stove, in which the gas is mixed with air in a cylinder or frustrum of a cone made of baked clay; the mixture is passed through numerous small perforations and burned. The clay becomes intensely heated, is surrounded by a cylinder of sheet iron with a tube to carry off the products of combustion, and gradually warms the air of the room.

Also, an apparatus for broiling, in which the gas is admitted into a hollow disk and burned in numerous small jets on its under surface, the meat being placed on a gridiron beneath. The whole is surrounded by a short sheet iron cylinder. There is a circular opening in the centre of the disk, so that air is drawn in beneath and around the meat, and carried off above, along with the products of combustion. The meat is thus cooked by radiant heat alone, not being exposed to the gases arising from combustion, or to any free gas which may accidentally escape being burned.

Dr. Rand also exhibited Mr. Andrew Mayer's self-regulating gas nipple. This is a small cylinder, screwed on the branch and to which the burner is attached. It contains metallic valves or washers, so arranged that only a certain quantity of gas can pass. It is varied in size according to the capacity of the burner, so as to allow the maximum quantity to pass to attain an economical effect, after which no increase of pressure causes any additional flow of gas. Mr. Mayer claims as new, the peculiar mode of packing these valves in the cylinder, and his invention is at present under consideration by the Committee on Science and the Arts. Dr. Rand had used one of these on a patent Argand burner, which was very troublesome from its constant fluctuations with those of pressure, due to the proximity of large public buildings. He had found it entirely effectual, but had not had it in use long enough to be satisfied as to its results during a long trial. He had noticed one remarkable effect from its use. Owing, he presumed, to the retardation of the flow of the gas, the flame of the burner took a different form after its application. Instead of presenting the appearance of an inverted cone with a flaring base and somewhat unsteady character, the flame became elongated and entirely steady, resembling that of a Carcel lamp, or of an ordinary Argand.

Dr. Rand called the attention of the members to a dissected leg, preserved by the process of his friend, Dr. John H. Brinton, of this City. After alluding to the disadvantages of the ordinary methods of preserving anatomical specimens by immersion in alcohol, or dessication after injection, Dr. Rand remarked, that Dr. Brinton had, after a series of well-directed experiments, succeeded perfectly in retaining the natural size, form, and appearance of the specimen, by coating it with gutta percha from a solution. The specimen has the appearance of the purest papier maché preparations, and possesses the advantage of presenting not only the natural color of the tissues, but also the relations of the muscles, vessels, nerves, &c. A full account of the process will appear in the forthcoming number of the *Proceedings of the Academy of Natural Sciences of Philadelphia.*

Dr. C. M. Wetherill exhibited an improved modification of Hess' apparatus for organic analysis, in which he makes use of a peculiar form of gas jet for heating the combustion tubes.

(A detailed description of this apparatus will be published in a future number of this Journal.)

Mr. B. F. Day presented a model of an engine for using steam expansively in a second cylinder, and made the following remarks:

The first difference between this engine and others operating on the same principle that have preceded it, is in contradistinction from allowing the steam to pass directly from one cylinder to the other; the taking of the steam from the receiving cylinder to steam chests provided with valves and ports, by and through which the steam is admitted to, and exhausted from, the second cylinder, by which means I retain a longer expansive action of the steam.

The second difference consists in surrounding the second cylinder when used in connexion with a receiving cylinder, with a flue, through which the unconsumed combustible gases are passed after leaving the furnace, by which any loss from radiation will be avoided, and the steam in the cylinders will, to some extent, be reached with caloric.

(This invention is under consideration by the Committee on Science and the Arts.)

Mr. William Reed exhibited a model of his improved form of suspension bridge. He forms a hollow truss-beam of plate iron with cast iron ends the whole length of the span. In this the wire is suspended from the upper end of each extremity and passing towards the lower margin near the centre, the cable and tube being well supported by truss braces, which effect the double purpose of bringing the weight of the truss and all the superstructure of the span on to the cables, and holding the truss-beam in proper shape, acting as the ribs to a vessel.

The height of the truss-beam and the thickness of the iron of which it is made, are to be governed by the length of the span. The upper part of the truss-beam must contain sufficient material to resist the compression of the superstructure and load, and the two feet of the lower edge of the truss-beams with the cables, are to support the whole tension. Where the span is long and breadth of beam is required, in order to save material, the top and two feet of the lower edge of the beam may be made of plate iron, and the intermediate space filled in with wrought iron

bars, riveted from the top to the bottom, crossing each other, forming a lattice so as to preserve the stiffness of the tube or beam. Where footways are wanted, the floor-beams can be extended out for that purpose. By this arrangement the whole amount of the tension of the wire can be obtained, while the peculiar form of the truss-beam will cause any weight that may be brought on any part of the bridge to communicate to all parts of the span.

Mr. William C. M'Rea exhibited a new application of iridium, for which he has applied for a patent. It consists in the construction of "Electro-Receiving Magnets," with their contact-surfaces of iridium. The metal heretofore used for that purpose is platinum, which, although competent to resist the action of the atmosphere, fuses quickly when exposed to the action of the electric spark from a powerful battery in a short-circuit. As soon as the platinum surfaces become in a slight degree oxydized, the points adhere to each other, even when the main circuit is broken. This we may set down as one of the causes for mistakes, which sometimes occur in the transmission of a message by the Morse telegraph, the alphabet of which consists of dots, spaces and lines. It is evident, therefore, that if the points of contact of the receiving magnet adhere to each other when the main circuit of the line is broken by the transmitting operator for the purpose of making a space, that a dot and line, or dots alone, may run together, thereby forming upon the paper a letter or character quite different from the one intended by the transmitting operator.

Iridium being the most indestructible of metals, the advantages of its application, in this instance, are, that the surfaces of contact will last for a much longer time without requiring any change, and will secure a more perfect and unvarying surface of contact for the passage of the current, and prevent the adhesion of the points of contact together.

Dr. Turnbull made some remarks upon the indestructibility of iridium, and said that this new application of it by Mr. M'Rea, would doubtless be found of great importance in the art of telegraphing.

Dr. Turnbull brought before the meeting "a model of a new form of telegraph battery, for which a patent was applied for by C. T. Chester, Esq., of N. Y., Feb. 10, 1854. Dr. Turnbull remarked that this battery, while it does away entirely with local action, employs the cheapest materials and the most convenient arrangement of parts. Its cells are large, of strong glass, and they are insulated from the shelves by a partial coating with electrophorus. Its metals are amalgamated zinc and a peculiar platinized and peculiarly insulated plate, the result of much study and experiment. The plates are supported by metal clamps and thoroughly insulated wood. The construction is such as to secure perfectly against any crossfire. The plates can be removed and cleaned separately, without stopping the working of the battery. The solution used to excite it is a dilute sulphuric acid. How free it is from local action may be inferred from the fact, that it has been in constant use for five months without being taken down, and that the zincs last such an unprecedented time. The relative cost of working these three batteries, without taking local action into consideration, supposing each equally free from local waste, is as follows; and the estimate is made up from actual experiment, by comput-

ing the destruction of battery material in each, necessary to accomplish a given equal amount of work—say the deposition of a pound of silver in the decomposition trough. To accomplish this,

Grove's consumes—

1½ pounds nitric acid, at 12c. . . .	18 cents.
1¼ pounds zinc, at 10c., ...	12½ "
1 pound sulphuric acid, ...	2 "
	32½

Daniell's consumes—

4 pounds sulphate copper, at 11c., . . .	44 cents.
1½ pounds zinc, ...	15 "
1 pound sulphuric acid, ...	2 "
	61 cents.

The new battery—

1½ pounds zinc, ...	15 cents.
3 pounds sulphuric acid, ...	6 "
	21 cents."

COMMITTEE ON SCIENCE AND THE ARTS.

Report on Mr. Charles D. Thum's Varnish Brushes.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination, an "Improvement in Varnish Brushes," invented by Mr. Charles D. Thum, of Philadelphia, Pennsylvania—Report:

That the improvements claimed by Mr. Thum, consist:

1. In the form of the handle. This is extended below the ferrule, where it is expanded and beveled into a wedge. This gives a greater elasticity to the brush, and renders it superior, in this respect, to any before known to the Committee.

2. In the oval form of the brush. It has been customary to give a beveled form to the varnish brush, by grinding it upon a stone, or by long use upon coarse work, as house-painting. This, however, destroys, in a great measure, the *flag*, and thus impairs the smoothness and evenness of the edge. Mr. Thum gives the beveled form by the arrangement of the hair, the flag being unimpaired. This gives a clean edge, and brushes thus made are found very convenient for working in corners and along edges.

3. In the use of *elastic hair*. The mode of selecting and preparing this hair is not disclosed by Mr. Thum. It appears on examination to be finer, darker, more glossy and elastic than the ordinary hair, and is

flat or oval rather than cylindrical. While a brush composed of this material is more elastic than one of ordinary hair, keeping in better form, the hairs have never, in the experience of the Committee, been known to break or split.

The Committee believe these improvements to be original with Mr. Thum.

On the whole, his brushes are regarded by the Committee as superior to any, whether of foreign or domestic manufacture, which have come under its notice. This opinion is founded not upon mere examination, but embodies the result of actual trial during many months by members of the Committee.

In view of these facts, the Committee fully endorse the opinion of the Committee of Exhibitions, by which a first premium was awarded for the specimens of these brushes deposited in the last Annual Exhibition, and further recommend the award of the *Scott Legacy Medal* and *Premium*.

By order of the Committee,

Wm. Hamilton, *Actuary*.

Philadelphia, June 8, 1854.

Report on Dr. Samuel B. Smith's Electro-Magnetic Machine.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination, by Mr. Wm. H. Hazzard, an "Electro-Magnetic Machine," invented by Dr. Samuel B. Smith, of the City of New York, Report:

That the peculiarity in the machine consists of an arrangement whereby a succession of shocks may be given to the patient, either from the secondary or from the primary currents at pleasure; whereas, in the ordinary machines, the secondary circuit only can be used for this purpose.

To obtain a shock from the battery or primary current, the circuit is divided before it enters the small magnet, which acts as a brake-circuit, the branch passing to the cord and handle, from whence the current passes through the patient and back to the other handle and cord, to reunite with the original circuit after its passage through the brake-circuit. When the connexions are first made, the current passes through the brake-circuit magnet, and by the attraction of the keeper interrupts the circuit; then if the circuit be completed through the branches, the current will pass by that route, returning to the other when the cessation of the magnetic influence allows the keeper to recede, and thus to open the more direct path.

The arrangement is simple and ingenious; and although it has been made before experimentally by a member of this Committee, (Mr. Weygandt,) has not, so far as the Committee know, ever before been published, or applied in practice. Dr. Smith is therefore entitled to the full credit of the invention.

As to its utility in medical practice, or its superiority over the secondary or induction current, the Committee do not feel competent to express any opinion, though it is but fair to mention that they have heard a very favorable opinion expressed of it, by a medical gentleman of this city,

whose scientific knowledge and experience give great weight to his opinion.

The Committee recommend the Committee on Exhibitions to award to Dr. Smith a first premium for the Instruments deposited in the last Exhibition.

By order of the Committee,

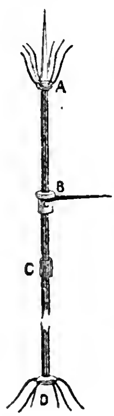
WM. HAMILTON, *Actuary.*

Philadelphia, June 8, 1854.

Report on Mr. Gatchell's Model of a Lightning Rod.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination by Mr. A. C. Brown, the "Model of a Lightning Rod," constructed by Mr. J. L. Gatchell, of Elkton, Maryland—REPORT:

That in the proposition presented by Mr. Brown, no claim is made for any "new invention," but for "a new combination and arrangement of what has heretofore been used." In effecting this new combination, which is intended to include in it all that has heretofore been by experience found useful, the requisite attention has been paid in succession to the point, the body of the rod, and its termination in the ground.



In regard to the point, it is constructed by "sharpening the iron-rod so as to receive the usual gilt platina point; sliding down on this point, is a ball or button of zinc, into which are cast six or more pointed copper wires, each diverging from the main point." This arrangement is credited to Dr. Hare, to whom it belongs.

There can be no doubt of the increased efficiency of a rod thus constructed, although we think that the reason given by Mr. Brown for this increase, is not the true one. There is, so far as the Committee know, no experiment to show that a single point, when in good condition and properly connected with the earth, is not quite sufficient to discharge the heaviest thunder cloud quietly and more rapidly than the cloud can approach it. In all cases where a pointed lightning rod has been struck, and where an examination has been made, the connexion with the earth has been found defective.* But if it be remembered, that Professor Henry has shown that a lightning rod is so far under the influence of a thunder cloud, even at a distance of twenty miles, as to indicate a current through the rod sufficient to magnetize needles, whenever a flash takes place from the cloud; and if we farther notice that when the cloud is at a distance

* This opinion applies especially to conductors on land, for Mr. Harris has given cases of ships being struck at sea, where the lower connexion was probably perfect. But, laying aside the question of defective conduction in chains, to which our remarks on the inductive effects of the lightning rod are peculiarly applicable, these instances would seem to strengthen the explanation we have given of the brush; for a ship at sea will be heeled over to leeward, and have the point of the rod directed away from the cloud, thus losing the first effect upon which we have particularly insisted.

from the rod, the upright point is not presented towards it, and is therefore comparatively, if not totally, inefficient, it will be seen that the brush of points diverging from the rod will be useful, because one at least of them will point towards the cloud, while approaching, at such a time before its reaching the striking distance, as to allow the whole of its electricity to be discharged silently and unnoticed. For it must be insisted on, that the true function of the lightning rod is not to receive a spark from the cloud, and to convey it harmlessly to the ground—whenever this happens, there is insufficiency in the system—but it is to begin its influence by induction, upon the cloud when at a distance, and by the continuance of this influence, to discharge the electricity in a silent and unnoticed current, so that when the cloud, pushed before the wind, passes near the protected mansion, its dangerous content has entirely disappeared and it floats harmlessly on its journey. This view follows necessarily from the experiments of Franklin on the influence of the point, and from the beautiful explanation which Faraday has given of this influence. It serves also to explain why the efficiency of the rod depends upon the area of the cross-section, and not upon its surface. The Committee are aware that Mr. Harris has explained this differently in his excellent treatise upon the lightning rod; but we regard his explanation as erroneous, since Henry has clearly shown by experiment that electricity of tension passes entirely by the surface, and not through the mass of the conductor, and that when passing over a plate, its self-repulsion is such as to cause the greater part to pass by the edges, rather than distribute itself uniformly over the area. The inductive effect, however, which is produced in a rod by a cloud at a distance, will be necessarily of such low tension as to resemble the galvanic current, which, as is well known, passes through the body of its conductor, and not over the surface alone. While therefore, we agree as to the practical value to be attributed to the brush termination of the lightning rod, we suggest the necessity of bending the points outwards, so as to make a large angle (say 45°) with the vertical, as has been done in this rod, although it is not noticed in his communication.

The action of the zinc ball, to prevent or retard the oxidation of the copper rods, is unquestionable.

To form the body of the conductor, "iron rods are put together with screw sockets (same as gas pipes)." There can be no doubt of the propriety of this plan, or that of soldering, for too much stress cannot be placed upon the necessity of maintaining a perfect metallic contact between all parts of the conductor. The method so commonly used, of linking the joints of a rod together, is altogether inefficient, and could only have been adopted under the erroneous notion before alluded to, that the rod is to receive a spark from the cloud. Were this the case, no doubt an interval of even a quarter of an inch, of an imperfect conductor, such as iron-rust, would make but little difference, (except under peculiar circumstances, such as the vicinity of large masses of metal, &c.,) for the discharge which has tension enough to pass over a hundred or more feet of air, will not be turned from its course by a half-inch of iron rust. But such is in reality by no means the case, as we have endeavored to show. The effect of the rod begins while the cloud is at a distance,

and if it be in good order, the cloud should be discharged before it comes into its vicinity. The current thus generated is, however, very feeble, and if it be interrupted by the slightest breaks, the good effect of the point ceases, until tension be accumulated sufficient to force the passage—the electric effect shows itself in sparks, the cloud is but slowly discharged, and there may, perhaps, be a danger of the rod receiving an amount of electricity which it cannot instantly and harmlessly convey to the ground. The joints of the rod should be, therefore, screwed or soldered together, or both, and, as an excess of precaution, where the expense is not an objection, we would recommend that the rod should be of copper, which is a much better conductor than iron; though there appears no record of any thunder-bolt so heavy as not to be safely passed by a bar of iron of one square inch or even less of cross-section.

Where, however, the rod is of iron, as it will be in the great majority of cases, we have no hesitation in endorsing the opinion of Mr. Brown, that "the addition of the zinc ball and copper wires to the lower end of the rod will greatly facilitate the discharge of electricity into the earth." In fact, the Committee believe that the greater part of the accidents which have happened to buildings armed with what were supposed to be properly constructed lightning rods, have arisen from the rusting off of the iron, just below the ground. Generally speaking, the accidents alluded to are trifling, and are principally injurious by shaking confidence in the efficacy of the protection offered; but it is believed that the annoyance from them can most frequently be avoided by securing the free metallic communication between the bottom of the rod and the moist earth. In a city, this is best done by connecting with the gas or water pipes; in the country, the rod should be carried down to such a depth as to insure a constant supply of water. Particular attention to this point should be paid in the case of houses standing upon a hill, where during our continuous dry summer weather the earth is apt to become baked to a very great depth. In such cases, the electric discharge has been seen to pass from the foot of a lightning rod, over the surface of the ground, (probably conducted by the moisture of the grass,) to the springs at the foot of the hill.

Both the zinc balls should be soldered to the rod.

The Committee also agree in the opinion expressed by Mr. Brown, who "does not consider the insulation of a rod important, and has adopted insulators only on account of the time-honored custom of using them."

The law of an electrical discharge is, that it will divide itself between the conductors offering themselves, so that each conductor will take a quantity inversely proportioned to its resistance. Now, if the lightning rod be in perfect metallic contact throughout, and well connected with the ground, the resistance which it offers is almost infinitely less than can be found through any materials of which a building is usually constructed. Cavendish found that water, which is the best conductor after the metals, conducted electricity with 200,000 times less facility; and even though we assume that this number is far too large, yet margin enough is left to justify the assertion that, with a well constructed rod, the divergence of the discharge through any except a metallic conductor is practically unimportant. But this conclusion assumes the rod to be perfect in

all its conditions; for if, whether owing to deficiency in its point or in its conducting capacity, it be struck, it is well known, by the experiments of Faraday and others, that portions of the passing discharge may be drawn off as sparks, and that these sparks will sometimes pass through a considerable distance of a non-cònductor. (See *Sturgeon's Kite Experiments.*) Such phenomena (known as the lateral discharge) are annoying, and may in some cases become dangerous; but it is doubted whether insulation is the true mode of avoiding them.

Similar phenomena, perhaps, still more frequently occur, from the inductive effect exerted by the discharge during its passage, upon any masses of conducting bodies insulated from the rod. Such bodies become charged during the passage of the current, and upon its ceasing may give off sparks as they themselves return to the neutral state, which sparks may be a source of annoyance or even danger. The true method of avoiding these effects is to connect every mass of conducting matter at both ends with the rod itself, when every indication of the kind, whether it be due to the branch discharge or to the inductive effect of the primary current, will cease.

Where two rods are erected, they should be connected together along the ridge-pole of the roof.

The Committee, therefore, in conclusion express their opinion, that in the lightning rod submitted by Mr. A. C. Brown, proper attention has been paid to securing the best conditions which a lightning rod should possess; and they believe that the rod, as proposed to be constructed, may and ought to be recommended by the Franklin Institute, as being in a very high degree cheap, durable, and efficient.

By order of the Committee,

William Hamilton, *Actuary.*

Philadelphia, June 8, 1854.

BIBLIOGRAPHICAL NOTICE.

Pocket-Book of Mechanics and Engineering, containing a Memorandum of Facts and Connexion of Practice and Theory. By John W. Nystrom, Civil Engineer. Philadelphia: Lippincott, Grambo & Co. 1854.

This valuable little Pocket Book is intended, as its title imports, to serve as a memorandum book for all facts and formulæ, which are likely to be frequently wanted by a practical man in any branch of the mechanic arts. A work of this kind, although making no claims to high scientific character, yet requires some of the highest and, in this country at least, most unusual scientific attributes for its proper compilation; accuracy in facts, method in their arrangements, fullness in details, clearness in statement, and with all brevity, are essentially requisite for a guide-book for the practical mechanic, and they are the same qualities, which, with the addition of original conception, form the perfect scientific character.

Among the many engineer's and mechanic's pocket-books which abound in our shops, we have as yet met with none which combines so many of the above requisites as this little book which we are now noticing.

Its preface states, that it is the printed form of the manuscript memorandum-book, which has accumulated in its author's pocket during his practice as a mechanic and engineer, and the facts and formulæ which it contains have been tested by his long experience. These have been put together in an orderly manner, beginning with the most simple rules of arithmetic and geometry, and extending through the general tables, which are more or less required in all branches of the arts, until it terminates with the technical statistics of the engineer, the navigator, and even the astronomer. Within the small space which it occupies, it includes a much greater variety of matter than is usually seen in such books, and the matter thus included appears to be judiciously selected for the wants of the class of men for which it is intended. We are very glad to find that in addition to the usual tables of squares and cubes, square and cube-roots, areas and perimeters, and solid contents of various geometrical figures, Mr. Nystrom has given a table of logarithms to five places, (sufficient for all ordinary mechanical calculations,) by means of which all calculations are so much facilitated as to become rather pleasant than troublesome, even to the most uninstructed. In fact, we regard the introduction of the habit of using logarithms among our mechanics, in place of the laborious and tedious modes of ordinary arithmetic, as one of the greatest improvements that could be made in our arts, and welcome heartily every book which tends to draw the attention of working-men to the subject. Heretofore, they have been deterred from even looking at it by the impression that it was some great mystery which they could not understand, or could not, at least, habitually use; but now that our boys of all classes can receive such an excellent education in our public schools, and, in consequence, our workshops are filled with young workmen of far greater mental culture and intellectual power than their predecessors, the use of logarithmic calculations should be encouraged, and, if necessary, insisted on. The mechanical solution of triangles and the movable diagram, which Mr. N. has given for this purpose, will much facilitate rough computations and give clearer conceptions of the more elaborate methods. The tables and explanations in reference to Sound, Light and other Physical Phenomena are accurate and valuable.

The most apparent defect of the book—and this is rather apparent than real—is in the want of entire familiarity with the English technicalities, not to be wondered at on the part of a foreigner, but giving to the book an unfamiliar air, which may retard its usefulness. In many cases he has literally translated the foreign technical term, in place of using its English equivalent, and although we have not met with a case in which the meaning is not perfectly evident, yet the book would probably look more inviting if it were otherwise rendered. We hope that in the next edition (and it will be both to the credit and the benefit of our workshops that one should be speedily required) this trifling fault will be corrected; the book will then be in all respects one of the very best of its kind.

Ed.

JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS.

AUGUST, 1854.

CIVIL ENGINEERING.

For the Journal of the Franklin Institute.

Rough Notes of an Exploration for an Inter-oceanic Canal Route by way of the Rivers Atrato and San Juan, in New Granada, South America. By John C. Trautwine, Civ. Eng., Philad.

Continued from p. 11.*

This afternoon the rain commenced at five o'clock, and continued with intervals during the night. The river, however, fell four inches.

Early next morning, after a cup of coffee, we started with the intention of breakfasting in Baudó, which we were told was about half a day below.

Some two miles below our starting place, we passed a rock bluff, fifty feet high, composed of the gray indurated clay, with fragments of shells.

At noon, having traveled sixteen miles, we reached the mean little town, village, or whatever it may be called, of Baudó. (See Plate II.) It is situated on the west bank of the river, fifty-four miles below where we embarked upon it; and, as we afterwards found, twenty-four miles above its outlet into the Pacific.

Thus far we have seen the Baudó in about its ordinary stages, or perhaps a trifle below them, inasmuch as the line of no vegetation was every where a little above water. With the exception of those spots at which low hill spurs, or bluffs, presented themselves, the adjacent land on both sides was flat and swampy, especially a little back from the banks.

* Errata.—Page 9, 12th line from bottom, for 85 miles, read 78 miles.

The height of the levees above the water, as we saw it, generally ranged between five and ten feet as extremes; and throughout all their extent they are occasionally overtopped by the floods. At the village, we found the bank at the water's edge to be ten feet above the water when we arrived; but were shown marks of a freshet which had submerged it from six to eight feet, rising about three feet above the floors of the highest huts.

The narrow strip of soil between the levee and the foot of the hills immediately back of the town is all swampy; and even the top of the levee is kept so soft by the incessant rains, that rows of stout poles are laid along it by way of paving.

Here the width of the river is 110 yards; and this limit is rarely exceeded between the town and the ocean.

Precisely opposite the village, the little River Pepé comes in from the East. (See Map XII. vol. XXVII.)

A few rods above their junction, the Baudó gave soundings of twenty feet for nearly half its width; and at a few rods below, of thirty feet for the same distance.

The current was $2\frac{1}{4}$ miles per hour at this time; but when, some days afterwards, we reached here again from the Pacific, the water had risen about five feet, and the current had increased to near $2\frac{1}{2}$ miles per hour in the swiftest part of the cross-section.

We were told that when the Baudó was at its very lowest stages, the influence of the Pacific tide was sensibly perceived, not only here, but for some distance above.

This I presume to be the fact, for I suspect that the average fall of the Baudó from the village to the ocean, cannot *exceed* about three inches to a mile, or six feet in all; while I found the rise and fall of the Pacific tide at the mouth of the stream to be but about eight feet, instead of some twenty feet, at Panamá.

The village contains a church, (seen on the left of the sketch;) and about a dozen cane huts, with floors elevated three or four feet above the top of the levee. The largest and least inconvenient of these belongs to Señor Antoine Posso, a Frenchman, who, after having for several years resided in various parts of New Granada, at last took it into his head to settle down like a frog in this piece of swamp, some three feet below high-water mark. It is utterly inconceivable how any rational being, and especially a Frenchman, can prevail on himself to abjure civilization, and deliberately resolve to vegetate away his life in a horrible out-of-the-way hole like this. But Señor Posso appears to be charmed with it; perhaps on the principle of "better be first in a village than second in Rome."

He was standing on the bank when we arrived; and on our hailing him in bad Spanish, to inquire where Señor Posso lived, he responded in equally bad English, that he was that individual. We had a letter of introduction to him from Governor Conto; but before we had time to present it, we had been cordially welcomed, and ushered into his abode.

Our provisions had entirely given out the day before,—the mustard only remaining faithful to the last. We were therefore constrained, rather late in the afternoon, to venture a gentle insinuation that we had not yet

breakfasted. To our dismay, we ascertained that Baudó was the last place in the world in which to replenish our exhausted larder; and were compelled to the unpleasant conviction, that not only would it be entirely out of the question to procure supplies here for our remaining voyage, but that it even subjected our kind-hearted host to no little inconvenience to administer to our immediate wants, especially as we were regarded as coming decidedly under the head of "illustrious strangers."

Señor Posso contrived, however, to procure a chicken, which, with some rice and plantains, made us an excellent breakfast.

The afternoon and night being showery, and suggestive of in-door contemplation, Señor Posso concocted the essential elements thereof, in shape of a mixture of mata burro or kill donkey, panéla or coarse brown sugar, mantéca or liquid lard, and hot water. He then despatched an emissary, to invite the Cura to partake with us of his good cheer. The invitation was accepted, to our great gratification, inasmuch as the Cura proved to be an agreeable, well informed, and highly estimable person. His pastoral charge is one of considerable extent, embracing stations widely distant from each other. Among them are Baudó and Noanimá, the latter, an Indian village on the San Juan, and his head quarters.

We passed the evening very agreeably, in desultory conversation, chiefly respecting our several countries.

During intervals, I took lessons in segar-making from master Napoleon Posso, a bright, intelligent looking, little son of our host and a native mother.

Society here is characterized by a nonchalance, of which occasionally the most agreeable feature to our uninitiated selves was its novelty. An instance of it occurred to interrupt our conversation this evening.

A strapping, naked black fellow very unceremoniously entered the room, and without as much as a "by your leave," lay down on a table a few feet from us, to take a snooze. The position he assumed was such, that had he been a bomb, an accidental discharge would have placed our lives in imminent danger, inasmuch as he completely commanded our position, and would have raked our table fore and aft. Under ordinary circumstances, this incident would probably have passed unnoticed as an every day occurrence; but under the actualities of the occasion, Señor Posso very properly deemed it but a courteous concession to the clerical position of the Cura, and a manifestation of respect to the Doctor and myself as strangers, not to let it pass without a reprimand. He accordingly read the brute a sharp lecture on the impropriety of his conduct; but received for a reply, that the intruder considered himself a true citizen, and a thoroughgoing "Democratico," and as such, did not choose to inconvenience himself by any squeamish respect to the Cura, the strangers, or any one else. This said, he instantly brought his guns to bear even more fully upon us, by way of a practical illustration of his sentiments. Hereupon, the Cura calmly, but with severity, addressed him a few words, which evidently staggered him. I then threw in a cross-fire, telling him that we had many Democrats in our country; but that they did not, like him, consider a Democrat and a blackguard synonymous terms; and that in my opinion, his appropriate dormitory was the pig-pen. Our triple alliance prevailed, for the fellow sullenly rose from the

table, and without a word of reply quietly left the house. As he did so, a very emphatic sniggering outside proved that popular sentiment was with us, and that the decency party had achieved a glorious triumph. This was the only specimen of the genuine blackguard I ever met with in New Granada.

When we retired for the night, the room assigned to our use was tenantless, save by ourselves; but when we awoke at early dawn, we found that during the night the rain had driven about a dozen outsiders into it through the windows.

Next morning, after one more ineffectual effort to procure provisions for our voyage, we took a cup of chocolate; and started off for the mouth of the river, trusting to our fowling-piece for breakfast and dinner.

Notwithstanding the rain of the night, the river fell three feet.

Some five miles below Baudó, at a spot where the river is 100 yards wide, we found a depth of but 14 feet for nearly the whole width; with, however, a narrow channel-way of 18 feet near the concave side. This is about as unfavorable a section as any we had met with since entering the Baudó, except near the upper part, where we occasionally had but 14 feet as the greatest sounding. This spot is about one-third of a mile below the entrance of the Misará or Neguá, a stream of 100 feet in width; and the shoalness is probably caused by the deposition of matter brought down by that tributary. I doubt whether, in the very lowest stages of the river, there is ever less than nine feet depth of channel-way even here. All our other soundings between the town and the ocean, gave channels of from 20 to 30 feet, until we reached the little bay at the mouth. This bay is about one and a half miles long, by three-fourths of a mile average breadth; and at low water, has but from four to nine feet depth over almost its entire area.

Outside of the mouth of this bay is a bar which completely precludes the entrance of any thing but the fishing canoes of the natives. We approached this in many places as closely as the breakers would permit, into three feet water, but saw it completely dry throughout the greater part of its extent; and reaching, as nearly as we could judge by eye, a full mile out from the beach.

The rise and fall of the tide was between eight and nine feet; instead of about twenty feet as at Panamá; and we afterwards found about the same at the mouth of the San Juan, some fifty miles more to the south.

At the mouth of the river, and on the beach, we saw several very large caymans or alligators. There are also tigers in the hills bordering the banks. Frequently, under cover of darkness, both animals visit the huts and abstract an unfortunate porker.

The people are very apprehensive of attacks not only from tigers, but from alligators. My own opinion, however, is, that their fears are nearly, if not entirely, groundless. I have, on numberless occasions, been fully exposed to both; but have never perceived the slightest disposition manifested by either, to attack human beings. It is not improbable that, under the instigation of extreme hunger, they may do so; and perhaps, some such occasions have given rise to the fear that so universally prevails in all parts of this country that I have visited.

The hills, shown on the Map, (Plate XII, vol. XXVII,) and which the

Baudó generally intersects nearly at right angles, are laid down correctly in number, and very approximately so in position. None of them appeared to exceed above 300 feet in height, and many of them were less than 100 feet. They are all densely covered with trees and undergrowth.

The intervals between these hills is swamp-land, like that bordering the other portions of the river. For some five leagues above the mouth, the wetness of these swamps precludes all attempts at cultivation; nor are any huts erected throughout that distance, except the two or three miserable ones at the very mouth of the bay. The only spots available for this purpose, would be the sides of the hills. From these, also, fuel for steamboats would have to be cut, as there is scarcely any fit for the purpose in the low grounds.

We reached the mouth of the river after dark, on the same day that we left Baudó.

We however caught a glimpse of the broad Pacific, just as the sun was setting gloriously into its placid waters. It was the first sunset we had seen for about two months; and none but those who had been for a long time deprived of the noble sight, can imagine the emotions it awakens. Doctor Halsted and myself, waxed sentimental on the occasion for a few minutes, and should probably have indulged in some brilliant rhapsodies, had not our empty stomachs positively forbidden such ebullitions of fancy. Not a single breakfast had we seen fly across the river during the whole day; and as the sunset was immediately succeeded by dense clouds and pitchey darkness, we were very reasonably beginning to despair of shooting any game for the day. But "*nil desperandum*;" just as the last ray of hope had vanished into utter darkness, we thought we descried through the dim obscure, something white, which we judged might be within gunshot. Fearing, however, it might be a shirt on a human being, (although the whiteness almost forbade the supposition) we hailed. Receiving no answer, the Doctor fired at it, whereupon it subsided with a pathetic squeak. Paddling to the shore, we found, by aid of a lucifer match, that it was a large spoonbill duck, a species of bird which lives chiefly on fish, and which I had on more than one previous occasion endeavored in vain to eat. The hungry bogas, however, insisted, that with the aid of our mustard, it would, under existing circumstances, be "*magnifico*;" therefore in our despair we took it on board, and went on prowling our way in the dark, running our boat upon logs, and into bushes and mud for some time. At last we heard a response to our signal guns of distress; and guided by this, we let our boat stick on the next mud flat she pitched into; and having secured her to something or other, that we thought would not float away, we waded, up to our knees in mud, in the direction of the voice, which at last brought us to the hut of which we were in search.

A young man with whom we had met in Baudó the day before, had kindly given us a letter of introduction to his mother, who existed here; and as we emerged from the mud on to what appeared to be firm bottom, we saw the old lady herself, under bare poles, holding on high a flambeau for our guidance. She had been rousec by the unusual sound of our signal guns. They had, indeed, created quite a sensation in this ob-

scure spot, which, above all others, is entitled to be held as the "uttermost part of the earth." She stood at one of the sideless sides of her habitation, and held the light at the top of the long notched post which served as its entrance-steps. As we clambered up, we endeavored to quiet any apprehensions she may have entertained of hostile invasion, by assuring her that we were peaceful strangers, and moreover bearers of a friendly letter of introduction from her son.

Having made our salaams, we devoted a few minutes to praises of the house, its position, &c., (for which I hope we may be forgiven hereafter;) and then delicately broached the subject of breakfast. This our worthy hostess cheerfully volunteered to prepare, provided we had any thing to prepare it from; at the same time expressing her regret that she had not a mouthful to offer us. Although we were traveling in search of information, this was not exactly the kind we wanted; but to put the best possible face we could on the matter, we ostentatiously paraded our spoonbill. By aid of hot water and garlic, the old lady managed to convert this into something diabolical, a little before midnight. We forced it down, in the dark; and then, hanging up our hammocks to the posts of the hut, were soon pelted to sleep by a drenching rain, accompanied by very loud thunder, and magnificent lightning.

We occupied the next day in making observations on the bay, bar, tides, &c. The result was an entire, although most reluctant conviction, that the obstacles here to be encountered, must effectually prevent the Baudó from constituting a portion of an inter-oceanic canal route.

This unfortunate prostration of our hopes was, however, attended by one slightly mitigating reflection, viz. that it absolved us from the obligation of prosecuting further examinations of the partition ridge in search of a low pass, between the tributary waters of the two oceans.

My sole reliance for a canal, even of the limited dimensions of that of which I was in search, was now centered in the facilities that might be presented for that purpose by the upper portions of the Atrato above Quibdó, in connexion with the San Juan below San Pablo.

At the same time, I entirely abandoned, as sheer nonsense, my last lingering aspirations for a ship canal.

When, on ascending the Atrato, I found that the sudden deterioration of that stream above Vigia Cubarador, (produced by the abstraction of much of its water through Caño Tadia,) forbade all hopes of navigating by ships beyond that point, I at once struck out a new route for myself. This will be found laid down on the map (Plate XII, vol. XXVII,) extending from the Vigia to the Bay of Cupica; and was intended to be fed from the Atrato.

Misled by the falsehoods communicated to Humboldt, and since that time received as truth by all interested in an inter-oceanic communication, I had hoped that perhaps an almost unbroken plain did *really* exist in that latitude, stretching from the Atrato to the Pacific. But after having found a partition ridge of more than 500 feet in height at the head of the Pato; and learning from the patron of our ranchada, that the same ridge was still higher at the head of the Okimunguido; and from those who had frequently crossed it, at the head of the Napipi, that it attained a for-

midable elevation at that point, I relinquished all ideas of its practicability.*

Nature had kindly permitted some half dozen cocoa-nut trees to grow near our hut; and by means of this fruit, and some fine fish which by good luck were caught just in time for us, our hostess managed, by preternatural exertions, to have breakfast ready by 3 o'clock in the afternoon. This night, also, was cloudy, but as there was no rain until towards morning, the Doctor and I watched until long after midnight, hoping that the clouds would break away, and allow us to observe the latitude; but in vain. Thus we have been baffled in this object every night (nine in all) since we left Quibdó. It is not to be inferred, however, that the season was especially wet; on the contrary, it presented but a fair average of the weather for the whole year, for in this region the occurrence of twenty-four consecutive dry hours is something of a rarity; and two or three dry days in succession, are phenomena but seldom witnessed.

Next morning, we started back for Baudó, inasmuch as I had determined to ascend the Pepé, and by that route to reach Quibdó a second time.

We left without a mouthful of provisions, and with a tolerably good prospect of another day's fasting.

A few small tree-ferns to-day, near the mouth of the river, were the first we had yet seen; and in many spots we saw tall bamboos. Vegetation is every where dense, to the water's edge.

For fourteen miles, or about eight hours, we did not pass a single hut. The ground is too swampy, and liable to overflow, to induce their erection, or any attempt at cultivation.

We saw a few flocks of teal and ducks. Luckily, I shot a fine duck during the morning; and towards evening, at a negro hut, we expostulated half a dozen eggs from a dirty old hag, (I beg her pardon, "dark eyed Señora" is the term.) Soon after, we reached another hut, where we stopped for the night; and where, by an excess of good fortune, we procured a few plantains, two or three yards of sugar-cane, and a little mata-burro. Upon these and our duck, we breakfasted at nine in the evening; and if the merits of a breakfast are to be estimated by the gusto with which it is eaten, this was a capital one.

We retired in the midst of rain No. 10.

About noon, next day, we reached Baudó; not without feeling a little shabby at the reflection, that, although we should be very glad to see Mr. Posso again, Mr. Posso could not, by any possibility, be very glad to see us. Under this conviction, the Doctor and myself would have preferred, even at the risk of starvation, merely to pay him a ceremonious farewell call for a few minutes, and then push on up the Pepé; but the bogas, who had evidently made up their minds to spend the remainder of the day here, discarded all such excess of refinement, and strenuously opposed the proposition. They hoped that another effort to procure sup-

* A rude estimate, since made, of its cost, based upon the supposition that the ground to be traversed would not be more difficult than that in the latitude of the Pató, amounts to full $325,000,000.

A friend in London recently sent me a prospectus for the formation of a Company to construct a ship canal by the Atrato and Napipi route, at an estimated expense of $15,000,000, or less than one-twentieth of my estimate !!

plies might be more successful than their former ones; and in addition, pleaded excessive fatigue, and a wish to stop some of the leaks in the boat. Our sentiments of delicacy yielded to their piteous arguments, and we decided once more to quarter ourselves upon Señor Posso for the remainder of the day.

It had happened, most fortunately for us, that we had previously stopped at a hut a few miles below Baudó, to inquire for something to eat. Neither love nor money, however, could extort any thing in that line; but Dr. Halsted, finding a very sick child in the hut, gave its mother his professional advice regarding it, adding some appropriate medicine, which he happened to have in his trunk. Now, a real live "Medico" is here considered the greatest man in all creation, except, perhaps, the Cura; and I never failed to prefix a very emphatic "Doctor" whenever I addressed Dr. Halsted in presence of the natives. His gratuitous services on this occasion proved more availing than our exhibition of money, although backed by the enticing display of some half dozen empty claret bottles; for the mother forced upon him a bunch of plantains in grateful acknowledgment of his kindness. Our ability to contribute this addition to the common stock, served in some measure to mitigate our grief, as we again crossed Señor Posso's threshold. We received, however, that cordial welcome which only those who have "roughed it" themselves, know how to extend to others.

On the morrow, at daybreak, we took leave, and commenced our ascent of the Pepé; without having been able, in the meantime, to procure anything eatable for the voyage.

At four miles from the Baudó, the Pepé is full 100 feet wide, with a centre depth of from 14 to 18 feet; which at times becomes reduced to 6 or 10 feet.

At thirteen miles from its mouth, it receives the Sandó, coming from the South. At the junction, this branch is about as wide as the Pepé. It is sometimes traveled by canoes to near its sources, beyond which is a pathway, crossing a ridge which divides its waters from those of the Dipurdú, a branch of the San Juan. (See Plate XII., vol. XXVII.)

From the Baudó to the Sandó, the average width of the Pepé is 100 feet. At 15 miles, the width becomes reduced to about 80 feet; the center depth 10 feet for a width of four or five yards only; and but five or six feet for two-thirds of the entire width.

At sixteen miles up, we first saw semi-rock at the water's edge. It was the indurated gray clay, containing a little very fine sand, and comminuted fragments of shells. It afterwards occurs at four miles above, and then at many points along the stream. At the first point, its strata dipped eastwardly, at an angle of about forty-five degrees. On this rock lie the diluvial grey and yellow clays; the latter over the former.

Up to this point, the banks consist almost entirely of mud, frequently overflowed; and backed by swamps, as in the other streams. Beyond here, however, the clay banks begin to show themselves frequently, and at a greater height than below, being now from three to six feet above the present surface of the water, which is rather above the ordinary stage. Beds of leaves are interlaid between those of the mud and clay. Here, too, fine sand begins to take the place of the mud bottom, which now soon

gives way to coarse sand and silicious gravel. The stream also begins to be much obstructed by old logs and trees, which occasionally gave us a good deal of trouble.

At 20 and 21 miles above the mouth, we passed two low ranges of hills, (see Map, Plate XII., vol. XXVII.,) abutting on the south bank; and at 22 and 23 miles, two others, abutting on the north bank. They all trended somewhat west of north; and did not appear to exceed about 100 feet in the highest points.

By four o'clock in the afternoon, having gone 22 miles, we drew up at an Indian hut for the remainder of the day. (Plate III.)

The Pepé is here still about 80 feet wide. Its greatest depth at the time was four or five feet; but it frequently falls so low as barely to allow free passage to a large ranchada; while occasionally in floods it rises ten or twelve feet higher, overflowing its highest banks, and inundating the swamps back of them. The current was $1\frac{1}{2}$ miles per hour.

We had shot a couple of fine so-called wild turkeys during the afternoon, and having fasted all day, we readily accepted the offer of our Indian hostess to cook them for us. We found here a small patch of plantain trees and sugar cane, and so fared sumptuously. Our hostess was evidently a good housekeeper, for everything about the primitive establishment was scrupulously clean. The whole family presented an air of cheerfulness and good nature, that was quite exhilarating. The afternoon was a lovely one; a pleasant breeze played through the hut; and every thing tended to inspire such a sense of independence, and perfect abandonment of care, that as we lolled in our hammocks, smoking listlessly, until breakfast should be ready, we felt as if we should like to be Pepé Indians ourselves.

One of our bogas was troubled with tooth-ache, and our host offered to extract it for him, assuring him that from long practice he was quite expert in the dentistry line. His implements, although decidedly primitive, were very effective. They consisted of a stick of hard wood, pointed at one end, and a round pebble of some four or five pounds weight. The boga, however, declined his services.

The lady of the house was a good deal puzzled what to do with the plates, knives and forks, &c., with which we furnished her for preparing our lowly table on the floor. She had never meddled with such outlandish contrivances before, and was much amused at watching us use them.

It rained hard early in the evening, and at intervals during the night.

When about starting next day, we asked our friend how many hours it would require to reach the head of the Pepé. He did not understand this, and our patron explained that he did not know what an hour was. We then asked how many leagues we had to go, but this troubled him quite as much, for neither did he know what a league was. But on inquiring *when* we should get there, he replied, "about quarter way between mid-day and sunset.

We gave him some segars and several bright silver dimes in return for his hospitality. The first were highly prized; but he handed the latter to his little children, who at once signified their determination to convert them into a necklace for their pet pup.

About a mile and a half above the hut, or nearly 24 miles from the

Baudó, we passed the branch Beniguadó, which supplies about half the water of the Pepé. Like the Sandó it runs towards the San Juan, and heads (so our men said) near that stream.

Beyond this point the Pepé deteriorates rapidly as a boating stream, alternately contracting and expanding, and becoming extremely circuitous. Some of the bends are so sharp as to trouble a long ranchada to pass them. The passage is also much obstructed by logs, and overhanging trees.

A few miles above the Benignadó we found other ranges of hills, as shown on my map; these were higher than those seen yesterday, rising in places to full 200 feet. Their general direction was the same, viz. nearly north and south, or a little west of north.

About 11 miles above the hut, or 33 miles from the Baudó, we reached, at 1 o'clock, P. M., the point at which the Atravesía, or path across the dividing ridge, commences.

Here the Pepé varies in width from 20 to 40 feet, and we generally managed to pick out a boat channel of about 2 feet in depth. It is frequently, however, reduced to a mere gutter with a few inches of water. For some miles back, the banks were sometimes bluffs of from 20 to 50 feet high; but generally they ranged between but 6 and 10 feet above the very bed of the stream. The ground on which stands the rancho at the Atravesía, is 12 feet above the present water, but is covered at times by floods. The current at our place of disembarkation was about $1\frac{3}{4}$ miles per hour.

We did not see a single monkey on the Pepé. Birds also were very rare; but among them were two or three Eagles of moderate size; and a few Toucans.

The rancho at which we stopped was quite a large one, with three or four good sized rooms; and, inasmuch as the proprietor was a negro, the sides of the building, as well as the partitions, were closed. We saw no attempt at subdivision into apartments in any Indian habitation; but in those of the negroes, the practice appeared to be general. The latter usually aim also at the possession of certain rudely made articles of furniture, such as tables, boxes for clothes, &c., to which the Indians seemed entirely indifferent.

The gravel of the upper portions of the Pepé was silicious; some of the pebbles were as large as a man's fist, but none larger; neither did we see throughout the stream, any boulders, or the appearance of perfectly formed solid rock. Nor, up to this point, did the Pepé exhibit any of the wildness of the sources of the Pató, the scenery being very tame throughout.

We had kept a look-out for the India-rubber tree, but did not see one. The vegetation generally resembled that along the other streams, including a few bamboos.

As we had the whole afternoon before us, and found that we could not procure a boat on the other side of the ridge until next day, we devoted a few hours to bathing, and to washing our clothes. Not having anticipated so long a trip when we left Quibdó; and having brought but one change with us, we were obliged to do our own washing on several occasions.

One of the women of the house having crossed the creek as we were bathing, communicated the fact to the others, and we were honored by visits from all of them in turn. The only chance they should probably enjoy of seeing white human bodies was not to be thrown away, and they remained until their curiosity was fully gratified.

During the evening, several Indians who had been hunting in the vicinity, came to the house to spend the night. They had killed a variety of birds, monkeys, a peccari, &c. Their arms were lances, and bows and arrows. The latter were poisoned, according to the invariable custom here.

A good deal of mystery appears to be involved in the preparation of their poison, and we could not get at the true nature of its ingredients, although we had repeatedly made inquiries on the subject. Our bogas insisted that a small green frog furnished one of the elements; and on the Pató, our patron had pointed out to us one of these animals, assuring us that it was extremely venomous, and cautioning us particularly not to touch it. Doctor Halsted had, however, all along entertained but an indifferent idea of the venom of either the frog, or of the poison itself; and without heeding their cautions, caught the frog, and played with it in his bare hands for some time, to the great horror of the bogas. They sagaciously ascribed his immunity from danger to his being a "Medico," and, consequently, endowed with a charmed life; an assumption that was confirmed by my declining the Doctor's pressing invitation to take the little dear in my own hands. To verify his suspicions of humbug in the poison business, the Doctor had taken the precaution to purchase supplies of it at our various stopping places; and I must admit that his subsequent experiments with it, went far to bring me over to his views. We certainly could kill nothing with it, nor did it even produce sickness in the different animals which we subjected to its operation. Moreover, we observed that all the birds, monkeys, &c., that we had seen killed with the poisoned arrows, had received wounds that would have effectually deprived them of life without any extraneous aid from poison.

Confident that the collection of the Philadelphia Academy of Sciences could not boast the scull of a Pepé peccari, I at once struck a bargain for the one brought in this evening, with a view of adding it to the museum of that Institution. The entire skeleton would have been troublesome to prepare in time, or it also would have been secured. The only proviso exacted in the premises was, that the women should first be allowed to convert the head into soup by boiling it; and as the boiling process was precisely what was needed to prepare it for transportation, I gave my consent. Poor peccari, little did he dream, as on that eventful morn he washed himself in the tributaries of the Atlantic, and lunched at those of the Pacific, that ere another dawn he should figure in the double capacity of soup and science, in the hands of the ruthless Anglo-Saxon. Forgive me, if, O Peccari, peccavi.

Soon after our arrival, two of the bogas started off across the partition ridge, in search for a boat. They succeeded in procuring one at a hut some few miles down the Surúcco, the tributary by which we were to

reach the San Juan; and moved her up stream to within a league of where we were on the opposite slope of the ridge.

Note. The following paragraph should have been inserted on page 9, after the 13th line:

Our patron lived on the Okimunguidó, (sometimes abbreviated to Munguidó,) which enters the Atrato a short distance below Quibdó. He informed me that there is a much traveled path leading from the head of that stream, across the ridge of partition, to the Baudó. He was very desirous I should examine that route, until he found that I pronounced the partition ridge at the head of the Pató (in connexion with other considerations) to be an insurmountable obstacle. He reluctantly admitted, that at the head of the Okimunguidó the ridge was much higher and wider than where we crossed it; and consequently, he desisted from his importunities that I should examine it.

A Description of the Sliding Caisson, at Her Majesty's Dock-yard, Keyham, Devon. By Mr. W. Fairbairn, M. Inst. C. E.*

The substitution of caissons, for the ordinary lock-gates, and their employment for closing the wide entrances of docks, have been somewhat extensively used, although the objections of occupying a considerable time, in having the water pumped out of them, and it being necessary to float them entirely away from the opening, before a vessel could pass, rendered them applicable only for special localities. The great width of opening required for the passage of ships of war, induced a rather general use of such caissons in the royal dock-yards; and at the new dock-yard at Keyham, where it was considered desirable to have the best accommodation for the newest class of large ships, the great breadth of the mouth and depth of the basin, induced the trial of a new form and arrangement of caisson, which should be of such capacity and dimensions as to resist the pressure of the water, effectually close the entrance, and still be so easy of manipulation as to admit vessels of war passing into the dock at any state of the tide.

The Keyham Docks were commenced in 1844, and they consisted principally of two capacious basins, with several entrances, or locks, from the sea. One of these, it was thought desirable to construct in such a manner, as to have the power of using it, when necessary, for a dry dock: its dimensions were 260 feet long, 80 feet wide, and 43 feet deep. The inner end, next the dock, was closed by a caisson of the ordinary form, and at the outer end, next the channel, the new caisson was tried.

The form of the caisson was that of a rectangular vessel, 82 feet 6 inches long at the top, 68 feet 6 inches long at the bottom, 42 feet high, and 13 feet 6 inches wide. It was built of wrought-iron plates, varying in thickness from $\frac{5}{8}$ths inch at the bottom, to $\frac{3}{8}$ths inch at the top; well supported throughout by an inside frame-work of angle-iron, and gusset pieces, and by two decks of iron and one of timber for the interior arrangements; but which, at the same time, imparted great strength to the structure.

* From Lond. Journal of Arts and Science. June, 1854.

The plates were connected by "butt-joints," with covering plates, attached by double and quadruple rows of rivets; and the bottom and ends were clothed with oak timber which bedded upon the cill, and against the jambs, when the caisson was in its place. The internal arrangements of the caisson were such, that when it was required to withdraw it from across the opening of the lock, by merely opening a valve, a sufficient quantity of water escaped from the upper chambers, to allow the body to rise a few inches from the bottom cill; when, instead of, as in the ordinary systèm, turning it round and floating it away, it was drawn back, by chains, transversely into a channel or opening in the masonry, at right angles with the lock,—leaving an opening of the clear span: and after the passage of the ship, it was drawn across again, and, by opening another valve, as much water entered as settled it securely on its bed or cill. This operation was stated to have occupied only eighteen minutes, for the passage of a line-of-battle ship; ten minutes for opening and eight minutes for closing. The total weight of the caisson was shown to be 290 tons: it contained 33 tons of iron ballast, and had an internal capacity for 323 tons of water. The mechanical arrangements were minutely described, and the general result appeared to have been very successful; and from the tabular statement of the deflexion of the caisson, under the pressure of various depths of water, the structure appeared amply strong for resisting either the dead pressure, or the concussions of the waves, which frequently beat heavily against the entrance of the docks.—*Proc. Inst. Civ. Eng. May 9th*, 1854.

AMERICAN PATENTS.

List of American Patents which issued from May 30th to June 20th, 1854, (*inclusive*,) *with Exemplifications by* Charles M. Keller, *late Chief Examiner of Patents in the U. S. Patent Office.*

MAY 30.

133. For an *Improvement in Sewing Machines;* Isaac M. Singer, City of New York.

Claim.—"I claim the method, substantially as described, of forming a seam with one thread, by carrying the thread through the cloth or other substance, with the needle, and forming the thread into a loop, and at the next passage of the needle forming another loop, which is drawn through the first or previously formed loop. Also, the employment of lateral pressure, whether by a cam, a lever, or their equivalent, to act against and in combination with the needle, at or near the end of its perforating motion, substantially as described, and to insure the proper position of the needle. Also, in combination with a needle for perforating the substance to be sewed or stitched, and carrying the thread through it, a looping apparatus to form a loop at each perforation of the needle, and consecutively liberating the previously formed loop over the one last formed, to effect the concatenation of the stitches. And, also, the looping apparatus, with a recess, into which the thread is drawn to form a loop, or its equivalent, substantially as specified, in combination with the lever, or its equivalent, for alternately opening the recess to receive the thread to form the loop, and closing it to shut in the last formed loop, and discharging the previously formed loop over the one last formed. Also, giving a positive motion to the spring arm guide through which the thread passes from the tension apparatus to the needle, by combining therewith the two bridles, or their equivalents, and the needle carrier, or some equivalent moving part of the machine, substantially as specified, the carrier

forcing up the said spring arm guide to the limit governed by the fixed bridle, and the movable bridle forcing it down to make the slack. And, finally, the method of feeding the cloth or other substance to the needle, for the progress of the seam, by means of the foot or pad which holds it to the table, substantially as specified, by means of which the cloth or other substance can be turned on the needle as its axis, whilst the needle is in it, and the foot or pad is lifted up preparatory to the feed motion."

134. For an *Improvement in Sewing Machines;* Isaac M. Singer, City of New York.

Claim.—"I claim the method of imparting the feed motion to the feed wheel, by means of the cord connected at one end with the adjustable arm of the rock shaft, and the other with the reaction spring, when this is combined with the friction brake, operating substantially as specified. Also, governing and regulating the tension of the needle thread by means of the wire with its edges or guides, substantially as specified, in combination with the turning wing, by which the coiling or winding of the thread around the wire can be increased or decreased at pleasure. And, finally, in the sewing of leather, causing the needle thread, on its way to the needle, to pass through linseed oil, or its equivalent, mixed with a dryer, substantially as specified."

135. For an *Improvement in Processes for Galvanizing Metals;* Christian B. Miller, Wilmington, Delaware.

Claim.—"I claim the construction and application of the rotary reticulated immersing cylinders or receptacles, and the use thereof, in combination with the melting and drying apparatus and diaphragm tanks, for the purpose of rotary dipping, substantially as described."

136. For an *Improvement in processes for treating Gutta Percha;* John Murphy, City of New York.

Claim.—"I claim incorporating with gutta percha, substantially, the proportion of sulphur, or its equivalent specified, and then subjecting it to such a degree of heat and for such a length of time as to expel therefrom its injurious volatilizable ingredients, preparatory to vulcanizing the gutta percha thus treated, or for using it in the condition that my said process of treatment puts it into."

137. For an *Improvement in Dyeing Processes;* Chas T. Appleton, Roxbury, Mass.; patented in England, 20th August, 1853.

Claim.—"I do not claim dyeing fibrous materials by subjecting them to pressure while they are allowed to lie in bulk within the dyeing liquid, as this has been essayed before, but has failed to be productive of my useful result, on account of the impossibility of obtaining by this means a uniform action of the dye upon the material; but what I do claim is, controlling the pressure of the atmosphere during the process of dyeing, by means of exhaustion, pressure, &c., in combination with the method described, of keeping the folds of the goods separated from each other by keeping the fabric constantly in motion, or by suspending it upon hooks within the vat, as set forth."

138. For an *Improvement in Corn Crushers;* Wm. Beal, Lowell, Massachusetts.

Claim.—"I claim the application and use of the peculiar form of tooth cut in the ribs, both of the cylinder and concave, the front of the tooth being shaped obliquely across the ribs, and every succeeding tooth being oblique in an opposite direction to the preceding one."

139. For an *Improvement in Knitting Machines;* John H. Barsantee, Philada., Penn.

Claim.—"I claim, 1st, The arrangement and combination of the two cylinders with a space between them, and supported and moved substantially in the manner set forth. Also, the ring in which the inside cylinder sits, and by which it is elevated or depressed; said ring being attached to the frame by set screws for that purpose. Also, vibrating the cylinder by means of the adjustable lever interposed between it and the gearing, or the equivalent thereof, substantially in the manner described."

140. For an *Improved Mode of Manufacturing Turbine Wheels;* Charles H. Bigelow, Lawrence, Massachusetts.

Claim.—"I claim, 1st, Attaching the buckets of turbine wheels to their rims or disks, by forming tongues or dove-tails on their upper and lower edges, and then flowing the melted metal used in casting the said rims about them, so that the rims, when cool, shall rigidly hold and embrace the buckets. 2d, Attaching the guide curves or diaphragms of

the turbine to their disk, by casting them in a similar manner in connexion with their disk; and, 3d, Using the guide curves of the turbine to sustain the weight of the disk, and of the water impinging upon the same, by casting the lower part of the iron flume around dove-tails formed on the said guide curves, so as to mortise them together, or by casting the lower part of the iron flume into holes formed in the said guide curves, so as to rivet them together, as described."

141. For an *Improvement in Hot Water Apparatus;* John Brown, City of New York.

Claim.—"I claim the curved return bends, formed with and on the upper part of the end of each pipe, to pass into and connect with the next pipe above, thereby allowing of the pipe being the full size of any flanch or socket that would be needed with a separate elbow, exposing more surface for the size of the apparatus, and preventing air remaining in the apparatus, as described and shown; and the construction and arrangement of the apparatus, for the purposess and substantially as specified."

142. For an *Improvement in Fastening the Disks and Rims of Car Wheels;* Abel Breær, Saugatuck, Connecticut.

Claim.—"The object of my improvement is, to provide for renewing the rim of the wheel, or the part technically known as the 'tread' thereof, and without the removal or waste of the central portion embracing the hub, and a part of the disk connecting the hub with the rim. I do not claim, for confining cast iron wheel rims to disk centres, the use of the bolts radial to the centre of the wheel, nor bolts whose direction is parallel to the axis of the wheel; but I do claim for confining cast iron wheel rims to single or double disk bodies or centres, the use of bolts whose direction is parallel with a plane perpendicular to the axis of the wheel, and whose direction is also in the course of circular arcs, described from the centre of the wheel; the bolts being either conical in form, or encased by conical sheaths, to facilitate such adjustments as shall secure the parts firmly togther, all substantially as set forth."

143. For an *Improvement in Hooks and Eyes;* J. H. Fairchild, Jericho, Vermont.

Claim.—"I do not claim the general device of bending the hook back or inward to prevent the eye from being loosened, but only when the body of the hook is bowed, and the point brought quite down within the bow. What I claim is, the peculiar form and construction of the hook, having its point brought round within the bow, as described, so as to prevent its being unintentionally unhooked, or becoming catched or tangled with clothing, hair, or other substances."

144. For an *Improvement in Vises or Chucks for Holding Cylindrical Bodies;* Charles Gregg, Brooklyn, New York.

"The nature of my invention consists in the formation of the jaws or holding parts of the chuck or vise, the opposite parts being dissimilar, the one for receiving the cylindrical body, the other to keep it in its place and prevent its turning."

Claim.—"I do not claim a cylindrical die or revolving circle, having scores or recesses in its periphery, except when such die is used in combination with another and smaller cylindrical die, having a groove cut in its periphery, parallel or nearly parallel with its axis, which form two sharp edges, that sink into the body to be held when pressed against it by means of the screw and slide, as described."

145. For an *Improved Machine for Cutting out Cloth;* John Harraday, City of N. Y.; patented in England, January 20th, 1854.

Claim.—"I claim, 1st, The employment, for the purpose of cutting several thicknesses of cloth or other fabric or material, of a reciprocating knife, which works through an opening in a table upon which the cloth is placed, and has one side and its edge working in or very nearly in close contact with the sharp edged plate or other sharp edge at one side of the said opening. 2d, The employment of a knife with the back extended in the form of a rod, as set forth. 3d, Making the table which carries the cloth, fabric, or material, with a loose centre piece, which contains an opening to receive the knife, and has its axis in line with the axis of the knife shaft, and is geared with the knife shaft so as to turn therewith, and at all times bear the proper relation thereto, as herein described."

146. For an *Improvement in Cameras for taking Stereoscope or other Daguerreotpes;* Silas A. Holmes, Brooklyn, New York.

Claim.—"I do not claim the mere operation of taking two pictures with two cameras, but I am not aware that two camera boxes have ever been attached together at the for-

ward edge, to be directed on to one object to be taken, by which means the axis of the cameras are directed on to the same object, and the object glasses are always the same distance from the object, which would not be the case if the two cameras were not connected together, the axis of the cameras at the object glasses (or daguerreotype plate) forming an isosceles triangle to the object, as indicated, whether the object be near to or distant from the cameras. Both cameras might be so fitted as to be adjusted in the inclosing, but it is believed to be superfluous. I claim attaching two camera boxes together, at or near their front vertical edges, and adjusting one or both of said cameras on to the object of which a daguerreotype or other view is taken, by means of the pinion and rack, or its equivalent, as described."

147. For an *Improved Stave Machine;* Carmi Hobson, Hannibal, Missouri.

"The nature of my invention consists in the combination of the rim and wheel, both provided with suitable cutters, and concentrically arranged about the same axis, and these in combination with a fixed rest, so that by passing the stave through between the inner periphery of the rim and the outer periphery of the wheel, both running in the same direction, the stave shall be dressed on both sides by a simultaneous operation, and without the use of auxiliary guides, yielding rollers, or other appliances than the said rim, wheel, and rest."

Claim.—"I claim the combination of the cutting rim and wheel, hung in the same vertical plane, with the fixed rest passing between their cutting surfaces, for the purpose of holding and controlling the stave whilst it is being dressed on both sides, substantially as described."

148. For an *Improvement in Hay Elevators;* Thomas T. Jarrett, Horsham, Penna.

Claim.—"I claim setting the catch free when the elevator reaches any desirable height, by connecting the said catch with a weight by a rope whose length is adjusted in proper relation to the height, as described, to make the weight operate on the catch precisely when the elevator reaches such a height."

149. For an *Improvement in Ventilating Window for Railroad Cars;* George Neilson, Boston, Massachusetts.

"I am aware that for the purpose of ventilating railroad carriages inclined or hinged flaps have been used on the sides of the windows or window openings thereof. I am also aware that a curved guard has been made to extend down on one side, and over the top and under the bottom of a window thereof. I am also aware that a window has been made in two sashes, each hinged to one side of the window, so that one may be made to stand inclined to the plane of the other, and to have an opening between them. I do not claim any such means of ventilating. I am also aware that pyramidal windows have been used on the tops of buildings. I am not aware that a ventilator window, to be applied to a railway carriage, has ever been constructed in the form of a frustrum of a pyramid, and provided with a window opening, and a closing window or door, composed in part or entirely of glass or other suitable transparent material. Nor am I aware that a ventilator window so made has had a deflecting rim or flanch applied entirely around its opening, and for the purpose of shedding rain and deflecting currents of air from the inclined surfaces of the window."

Claim.—"I therefore claim the frustro-pyramidal ventilator window, as made to top, bottom, and vertical sides or windows, and with an opening and a closing window, substantially as specified. And the arrangement of the deflector range entirely around the window opening, and in respect to the deflecting sides, as specified, not intending to claim a deflector or guard, as applied to a car window opening, but to limit my claim to its arrangement on four deflecting sides or planes, and entirely around the opening between them, as set forth."

150. For an *Improvement in Neck Yokes;* John R. Pierce, Castile, New York.

Claim.—"I claim placing the attaching rings of neck yokes upon racks passing on each side of a pinion movable upon the main bolt, or any arrangement substantially the same, for admitting of the equal longitudinal movement of the said rings, as set forth."

151. For an *Improvement in Quartz Crushers;* Daniel Poole, Mount Carmel, Illinois.

"The nature of my invention consists in the construction of a peculiarly grooved roller, and in the combination of a pair of said grooved rollers with a series of cylindrical rollers, used in pairs, for the purpose of crushing gold and copper quartz, the rollers being arranged

as described, and the ore fed steadily to the upper pair by means of an endless apron connected with the machine, and driven as set forth."

Claim.—"What I claim is, the arrangement and construction of the machine, substantially as described."

152. For an *Improvement in Knitting Machines;* Elias M. Ray, Providence, R. I.

Claim.—"I claim the combination of the series of radial and horizontal lifter wires and the stationary lifter cam, with the rotating set of needles, the same being made to operate substantially as set forth."

153. For an *Improvement in Sewing Machines;* Martin W. Stevens and Edward G. Kinsley, Stoughton, Massachusetts.

Claim.—"We claim, 1st, when the shuttle and feed motion are arranged within a cylinder upon or around which the work is placed, so arranging and operating the feed motion as to move the work longitudinally to the cylinder, substantially as described, in order that longitudinal seams may be made in articles of circular form. 2d, Attaching the pressure rollers to a collar which fits to a portion of the needle rod guide, or other suitable fixed part of the machine, in such a way, substantially as described, that they may be turned and readily secured to run either longitudinally or transversely to the cylinder or bed upon which the work is placed."

154. For an *Improved Typograph;* Robert S. Thomas, Wilmington, Delaware.

Claim.—"I claim the type holder with its types and corresponding guide holes, or their equivalents, in combination with the pin, the spring inking apparatus, and the revolving cylinder in its sliding frame, constructed and arranged substantially as specified."

155. For an *Improvement in Furnace Grate Bars;* Benjamin C. Vanduzen, Assignor to John Martin and Benjamin C. Vanduzen, Cincinnati, Ohio.

Claim.—"I am aware that grate bars have been provided at their lower edges with projections affording connexion for a steam or feed air pipe, and therefore make no claim to such projections, separately considered; but what I claim is, the form and arrangement, substantially as described, of furnace grate bars and bearing bars, the former being clear of the usual protuberances, for lateral support, and having each one a pivot at its rear end, occupying a socket in the bearing bar, so as while holding the rear ends of the grate bars to their proper places and relative distance, to capacitate them for lateral shifting at their front ends, at the option of the furnace man, without liability to dislodgement, or for removal of a portion without endangering the stability of those which remain, and for other objects, as set forth."

156. For an *Improvement in Self-Acting Nipple Blocks;* Wm. Waley, New London, Assignor to Jonathan Whipple, Jr., Hopedale, Connecticut.

Claim.—"I claim the construction and arrangement of the block, viz: placing the two pulleys and nipper between the check plates, and attaching said check plates by a joint to a standard, the upper part of which is curved or bent, and is placed a short distance below the pulley and nipper, so as to allow sufficient space for the rope to pass between the pulley, nipper, and end, when the two pulleys are in a horizontal line, by which arrangement and construction the block is made self-acting, operating in the manner set forth."

ADDITIONAL IMPROVEMENT.

1. For an *Improvement in Grinding Mills;* Oldin Nicholas, Lowell, Massachusetts; patented Oct. 12, 1852; additional improvement dated May 30, 1854.

Claim.—"I claim, 1st, The shortening of the frontal projection of each tooth in such a manner as to form a notch in their tops. 2d, I claim the corrugated ribs and concave, in combination with the teeth and corrugated cylinder, these teeth having their frontal projections shortened so as to produce or constitute notches on their tops, or with teeth without their frontal projections being shortened or notched on their tops, either or both."

Re-issues for May, 1854.

1. For an *Improvement in Cutting Boots;* Daniel Lynahon, Buffalo, New York; patent dated October 12, 1853; re-issue dated May 9, 1854.

Claim.—"I claim the tongue which gives the vamp a more exact crimped curve, covers the seam from being seen, and secures it from ripping, and keeps the seam permanent by receiving the strain which comes on them when drawing on the boot, which improvement may be applied to any material whatever, of which boots may be made."

2. For an *Improvement in Harvesters;* William H. Seymour and Dayton S. Morgan, Brockport, New York, Assignees of Nelson Platt, formerly of Ottoway, Illinois; patent dated June 12th, 1849; re-issue dated May 23d, 1854.

Claim.—"1st, The combination of a series of removable cutters with the links of an endless revolving chain, which carries them successively into contact with the grain or grass to be cut, substantially as described, whether the cutters be contiguous, or placed at intervals upon the chain. 2d, Making one end of each cutter sharp, in order that by pressing against the adjacent end of the next cutter, straw, grass, or other intervening obstructions may be cut in two, and allowed to pass out, the cutters thus freeing themselves from obstructions, which otherwise might either choke or break them. 3d, Making the cutters narrower at one end than the other, so that as they are carried forward by the chain in a straight line, they may present a series of inclined cutting edges, against which the stalks of grain or grass are pressed by the reel, or the progress of the machine, until severed, by which arrangement of the cutting edges their efficiency is greatly increased. 4th, The employment of a sweep or turning rake, for the purpose of sweeping the grain off the platform in such manner as to deposit it upon the ground with its stalks at right angles, or thereabouts, to the path of the machine. 5th, The method of vibrating a sweep rake, and turning its teeth so as to pass over the grain, and to seize and sweep it off the platform, whether the devices employed to effect these movements be such as described, or others equivalent thereto. 6th, The method of holding a sweep rake firmly, with its teeth at the proper distance above the platform, by a latch, or the equivalent thereof, which, operating with a greater certainty than a weight spring, or other fastening not rigid, more effectually prevents the rake teeth from rising so as to over-ride the grain, and at the same time avoids the necessity of moving a heavy weight, or overcoming the tension of a strong spring in elevating the rake preparatory to its retrograde stroke. 7th, The construction and arrangement of a sweep rake, and the mechanism for operating it in such manner that it is carried back and forth, and raised and lowered, without support at the outer end, thereby rendering it less liable to become entangled with the grain. and clogged or broken. 8th, The method of changing the frequency of the alterations of the rake or other device for discharging the grain by means of the wheels and pinion, or other equivalent devices for producing a differential movement, for the purpose of varying the size of the sheaves, as may be required, substantially as set forth."

Designs for May, 1854.

1. For *Cooking Stove or Summer Range;* John Abendroth, Port Chester, New York; dated May 2, 1854.

Claim.—"Is, to the combination of mouldings and ornaments."

2. For *Frames and Handles of Hair Brushes;* Hugh Rock, Assignor to H. Rock and Francis McLaughlin, Boston, Massachusetts; dated May 2, 1854.

Claim.—"Is, to the ornamental design."

3. For *Cooking Stoves;* N. P. Richardson, Portland, Maine; dated May 2, 1854.

Claim.—"Is, to the general ornamental design of the stove."

4. For *Doors of Gas Ovens or Summer Ranges;* S. W. Gibbs, Albany, New York, Assignor to North, Chase & North, Philadelphia, Penna.; dated May 9, 1854.

Claim.—"Is, to the design, consisting of a carved shield raised on a panel, the panel being surrounded by a moulding."

5. For *Clock Case Fronts;* Chas. Chinnock, City of New York; dated May 16, 1854.

Claim.—"Is, to the design and configuration of the plate."

6. For *Portable Cooking Ranges;* G. Smith, H. Brown, and J. A. Read, Assignors to Abbot & Lawrence, Philadelphia, Pennsylvania; dated May 23, 1854.

Claim.—"Is, to the design of the ornaments in bas-relief on the front and ends of the stove."

7. For *Cast Metal Clock Case Fronts;* Charles Chinnock, City of New York; dated May 23, 1854.

Claim.—"Is, to the design and configuration of the clock case front."

8. For *Fronts of Cast Metal Clock Cases;* Charles Chinnock, City of N. York; dated May 23, 1854.

Claim.—"Is, to the design and configuration of the clock case front."

9. For *Cooking Stoves;* Jacob Beesley and Edward J. Delany, Assignors to Cresson, Stuart & Peterson, Philadelphia, Pennsylvania; dated May 23, 1854.

Claim.—"Is, to the design for golden star cook stoves."

10. For *Parlor Stoves;* Jacob Beesley and Edward J. Delany, Assignors to Cresson, Stuart & Peterson, Philadelphia, Pennsylvania; dated May 23, 1854.

Claim.—"Is, to the design for the gothic queen parlor stove."

11. For *Portable Ranges;* John F. Allen and Joseph Stewart, Assignors to Cresson, Stuart & Peterson, Philadelphia, Pennsylvania; dated May 23, 1854.

Claim.—"Is, to the design for portable range."

12. For an *Oven Door;* John F. Allan and Jos. Stewart, Assignors to Cresson, Stuart & Peterson, Philadelphia, Pennsylvania; dated May 23, 1854.

Claim.—"Is, to the design for the oven door."

JUNE 6.

1. For an *Improvement in Knitting Machines;* Brown S. Wood. Burrillville, R. I.

Claim.—"I claim, 1st, The employment of a series of wide and narrow tongued jacks, arranged in any desired order of succession, to form short loops upon the frame needles, and lay long loops between certain of the said needles, in such a manner that they may be entered and caught by a set of rib needles, working parallel or nearly so with the frame needles, substantially as described. 2d, The method of giving a lead or advanced motion to the narrow jacks by means of the double slur, having one part wider than the other, and the recess made in the heads of the wide jacks, to prevent their being operated upon until the wide part of the slur comes in contact with them, and allow only the narrow jacks to be operated upon by the narrow part, substantially as set forth. 3d, The movements of the two sets of needles relatively to each other, that is to say, the front needles rising first and then remaining stationary to receive the loops upon and between them, the rib needles being in the meantime stationary, but rising after the loops are formed, and entering the loops intended for them, and then both sets of needles descending together to carry the loops through those previously formed. 4th, Arranging the rib needles at such a distance from the front needles, that their upward motion will not carry them through their loops, and springing their ends forward to the requisite position for the purpose by means of a presser, constructed, arranged, and operated substantially as described. 5th, Attaching the head which carries the jacks, the slur, and the thread carrier, to a frame which is capable of swinging back, substantially as described, to expose the needles, and afford greater facility for their adjustment, for the running on of the quarter, and for the repair of any damage to the machine, or to the web."

2. For an *Improvement in Balancing Slide Valves of Steam Engines;* Robert Waddle, England; patented in England, April 27, 1853.

Claim.—"I claim, 1st, The equilibrium table, with its ledges, or their equivalents, applied to and acting in combination with the valve, substantially as described. 2d, The packing pieces extending from the back of the valve chests and abutting against the back of the valve, in combination with the small passages leading to the ports, substantially

in the manner described. 3d, Combining the equilibrium table, or its equivalent, with the packing and small passages, by the joint action of which a slide valve is perfectly and entirely balanced."

3. For an *Improvement in Machines for Washing Bottles;* A. H. Rauch, Bethlehem, Pennsylvania.

Claim.—"I do not claim a folding brush for washing bottles, independent of its peculiar construction, as such brushes have been used before; but what I do claim is, a rectangular shaped folding brush, which has three of its sides made of solid strips, and set with bristles, which serve to cleanse the shoulder, periphery, and bottom of the bottle at the same operation, while its other side is made hollow, and serves as a canal for introducing a constant stream of clean water to the interior of the bottle to facilitate the cleansing operation, and the whole united together by loose joints in such a manner that when the brush is folded, the cross-piece which carries the brush for cleansing the bottom of the bottle will assume position in line and parallel with the hollow stem, while the pieces carrying the side and shoulder brushes assume a vertical position in line with each other, and lie parallely and snugly alongside the stem and bottom brush, substantially as set forth. I do not claim washing bottles in an inverted position; but what I do claim is, the employment of the revolving cone, or its equivalent, which is so arranged and operated that it takes hold on the bottle, which is inverted, and has its mouth resting in a socket, and causes it to revolve rapidly when the machine is in operation, and brings its inner and outer surface in contact with the inside and outside cleansing brushes, substantially as described. 3d, The employment of the stationary inside and outside cleansing brushes, in combination with the revolving cone, and inside and outside branch pipes of the elevated reservoir, the whole being constructed, arranged, and operating in the manner described. 4th, The self-adjusting arrangement for accomplishing the three following objects: 1st, Folding the expanding frame, and retaining it thus, ready for entering the mouth of the bottle. 2d, For elevating the revolving cone so that it may be out of the way when the bottle is being placed over the brush; and, 3d, For shutting off the supply of water while putting another bottle to be washed over the expanding brush. 5th, Arranging a spring between the supply stem and the side strip of the brush frame, for the purpose of expanding the brush as soon as it enters the body of the bottle, as set forth."

4. For *Improvements in Instruments for taking Deep-Sea Soundings;* Chas. F. Brown, Warren, Rhode Island.

Claim.—"I claim an implement constructed and operated substantially as described, for the purpose of sounding the depth of the ocean."

5. For an *Improvement in Brick Pottery Kilns;* Joseph Baron de Palm, now residing in the City of New York; patented in England, July 13, 1852; in France, Aug. 13, 1852; and in Holland and Belgium, September, 15, 1852.

Claim.—"I do not claim secondary or vapor chambers over the main chambers, forming an upper tier, with numerous apertures, through which heat passes from below; but what I claim is, a series of upper and lower chambers in kilns for baking or burning bricks and pottery, communicating with each other by apertures in the partition walls and floors, in combination with adjustable dampers or registers in the apertures in the floors between the upper and lower chambers, as described, for the purpose of regulating and controlling the heat in its ascent, and directing it to those parts of the upper chambers where it may be most required."

6. For an *Improvement in Combination of Railroad Tracks and Wheels;* Henry R. Campbell, Lebanon, New Hampshire.

Claim.—"I do not claim, as a part of my improvement, what is called the 'compound rail,' (or a rail composed of two or more bars in its cross-section,) so joined and fitted together as to form one continuous bar or rail on each side of the track to be used, with wheels of a single tread and a flanch on one edge in the usual form. Nor the invention of two railroad bars laid side by side, so as to be used under a wheel of single tread and flanch on one edge in the common form. Nor a rail with a groove in it, or two rails so arranged as to form a groove between them, to be used merely as a guide to the flanch upon wheels, having a bearing or tread on one side of the flanch only, in the common way. Nor a wheel with a flanch in its centre of tread, which is intended to run and bind in a grooved or double rail; or a grooved wheel, which is intended to bind upon a single rail of any form, or any similar contrivance by extra rails or wheels to create an unusual grip

or friction over what is due to weight, (as ordinarily applied,) on rails of inclined planes, as heretofore claimed or patented. The essential and distinguishing character of my improvement is, the double rail, in combination and use with wheels having a tread or bearing on each side of the flanch, as described. What I claim is, the combination of the wheel with the flanch in the middle of the tread (which shall be symmetrical on both sides of the flanch, as to diameter and tread), with the double line of rails so constructed that the flanch of the wheel shall run freely between said double line of rails, and with sufficient play or space between said double line of rails to avoid unnecessary friction against said flanch, and to accommodate the ordinary inequalities in the width and parallelism of the railroad track; the surfaces of said double line of rails to be level, or nearly so, and the two portions of the tread of the wheel to bear the whole weight of the wheel equally, or nearly so, on the surface of said double rails. The tracks and wheels to be arrranged for use in combination, and for application to railroad purposes, as set forth and described. The purpose and objects claimed for said improvement, as the result of the combination, when applied to railroad purposes, is increased economy in the track, engines, and cars, in power, speed, safety, profit, and usefulness of railroad communication."

7. For an *Improvement in Impressing the Thread upon Screw Blanks;* Sam. McCormick, Dublin, Ireland; patented in England, March 22, 1853.

Claim.—"What I claim is, the forming or impressing of screw threads or ornaments on the plain surface of screw blanks, or other plain shafts of metal, by means of three revolving dies placed triangularly on a suitable frame, and worked by mechanism, as described, or by the mechanical equivalents thereof, so as to produce the results described."

8. For an *Improved Berth Knee Former;* Donald Taylor, East Boston, Massachusetts.

Claim.—"I claim the combination and arrangement of the side rulers or bars, the slotted bars and bar, with the springs, the friction rollers, and set screws, or their equivalents, whereby a person is enabled to adapt the instrument or 'berth knee former' between any two timbers, and to the width for the berth knees, as set forth."

9. For an *Improved Machine for Dressing Polygonal Timber;* Henry Allen, Norwich, Connecticut.

Claim.—"I do not claim the employment of a pattern rail to guide a rotary cutting tool or wheel over a piece of work, as I am aware such has been used in machines for turning oars or other irregular forms; nor do I claim the invention of a tracer, permanently fixed to the frame; but what I do claim is, the improvement whereby the said cutting tool may be adapted to the reduction of a stick of any ordinary diameter, and to a size suitable to the stick, as described, such improvement consisting in combining with the tool frame, the sliding rest operated by the lever, and held in position by it and the perforated size plate, as specified."

10. For an *Improvement in bent Timber for Ship Frames;* William Ballard, City of New York.

Claim.—"What I claim is, cutting the heart out of artificially bent ship timbers at the curve or bend known as the 'naval timber,' and combining therewith an iron plate, curved so as to fit the curve of the timber, by inserting it in the place cut out of the timber, so as to be protected from rusting by the action of the atmosphere or bilge water of the ship, substantially as described."

11. For an *Improvement in Cultivators;* Whitman Price, Goldsborough, N. Carolina.

Claim.—"I claim the construction of the accommodating frame, having uprights and cross-ties or suspension bars, together with the compensating strap or equivalent. Also, the construction of the twisted obliquely curved blades or thinners attached to the radial arms, forming a rotary cotton thinner, and the using the same with the right and left double shank furrow shears, specifically as set forth, and as arranged with the cultivator, as described."

12. For an *Improvement in making Seamless Metal Tubes;* J. Pratt, Taunton, Mass.

Claim.—"What I claim is, extending and finishing seamless metal tubes by moving the mandrel and tube in a horizontal direction, while the rollers, or their equivalent dies surrounding the tube, are rotated, or moving the dies in a horizontal direction, and rotating the mandrel and tube, substantially as set forth."

13. For *Arrangement in Dampers in Rotary Stove;* Wm. W. Hill, Greenport, N. Y.

Claim.—"What I claim is, the combination and arrangement of the dampers with a revolving or rolling oven, as set forth."

14. For an *Improvement in Grain Mills;* Walter Westrup, Wapping, England; patented in England, January 24th, 1850.

Claim.—"What I claim is, the general arrangement and combination of parts described; that is to say, the use of two or more pairs of mill stones, the runner of each pair being mounted on the same vertical shaft, and arranged in such manner that when the meal escapes from the first pair of stones, it may be subjected to a dressing operation for the purpose of separating the already formed flour from the unground meal, leaving the unground meal, when freed from the flour, to pass through the second pair of stones and perfect the grinding operation."

15. For an *Improved Rivet Clamp for Wire Fences;* Matthias P. Coons, Brooklyn, N. Y.

Claim.—"I claim the peculiary constructed rivet clamp, and its application to wire fences, or for equivalent purposes, in the manner and substantially as described."

16. For a *Moth Killer;* W. A. Flanders, Sharon, Vermont.

Claim.—"I do not claim a blow pipe in which the flame of a lamp is urged by a stream of alcoholic vapor, generated by the heat of the lamp itself, as this forms no part of my invention; but what I do claim is, the described moth killer, constructed and operating in the manner substantially as set forth, the lamp being entirely protected from the wind and from being extinguished by the dead millers, and the flame blown through an opening in the side of the lantern, as explained."

17. For an *Improved Machine for Cleaning and Watering Streets;* Ross Deegan, City of New York.

Claim.—"I do not claim the rotary brush or the apron, as such have been used before in machines of this character; neither do I claim, of itself, the revolving fan or blower; but I do claim the method of removing dust from streets by means of a rotary sweeper beneath the machine, combined with a fan revolving at speed in an external chamber, which is connected by passages with the chamber which first receives the dust, and the chamber of deposit, as specified, by which arrangement the dust is driven within the action of the fan by the sweepers, and is by suction drawn to the fan chamber, whence it is driven to the chamber and there deposited, the air in passing out under strong pressure through the finer reticulations in the cover of said chamber."

18. For an *Improvement in Flouring Mills;* Edwin Clark and James M. Clark, Lancaster, Pennsylvania.

Claim.—"What we claim is, 1st, The double conveyor for the fine flour and middlings, constructed substantially as described, to wit: the conveyor for the middlings being attached to a tube inclosing the conveyor for the fine flour, the conveyor for the fine flour terminating in the receptacle, and that for the middlings terminating in a receptacle, and in combination with this double conveyor. We claim the arrangement of the receptacles, elevators, spouts for returning the fine flour and middlings respectively to the bolt and the eye of the mill, as set forth. And, lastly, The arrangement, in series, of spouts with their slide valves, in combination with the separate receptacles and conveyors."

19. For an *Improved Method of Turning Hubs;* Smith Beers, Naugatuck, Connecticut.

Claim.—"I claim the arrangement and the manner of operating a series of revolving cutters, for the purposes and in any manner substantially as set forth."

20. For an *Improved Device for operating Cutter Heads of Planing Machines;* Timothy F. Taft, Worcester, Massachusetts.

Claim.—"What I claim is, hanging the planing cutters to the vibrating arm, or its equivalent, in the manner set forth."

21. For an *Improvement in Vault Covers;* Alfred Brady, City of New York.

Claim.—"What I claim is, the cylindrical lens, having its upper face formed in the manner set forth, in combination with the india rubber or other elastic water proof packing and vault cover, whether made of wood or metal, substantially in form and manner of construction described."

22. For an *Improved Hydrant Cap;* Noah W. Speers, Cincinnati, Ohio.

"The object of my invention is to provide a remedy for the liability that the caps of stop-cock boxes are at present subject to, of being purloined or mislaid."

Claim.—"I claim the formation of the cap or cover of a stop-cock box with catch of width exceeding the play of the cap within the rebate, and with pivots whose distance from their confining flanches exceeds the depth of the rebate, (or devices substantially equivalent,) for the objects described."

23. For an *Improved Mechanism for Operating Pumps;* J. A. Whipple, Boston, Mass.

Claim.—"What I claim is, the combination of the wheel, the cogged segments, and the racks upon the end of the pistons, by which I attain an accelerated motion of the pistons at the same time that the power which actuates them is applied in a vertical line passing through their centre, great friction and wear of the pistons and pump barrel being thereby avoided."

24. For an *Improvement in Road Scrapers;* Samuel H. Dudley, Milton, Connecticut.

Claim.—"I do not claim scrapers, chains, hooks, or either of them as such; but what I do claim is, the combination of the bow or bows with the scraper, for the purpose set forth, and in a manner substantially as described."

25. For an *Improvement in Machines to Print Subscribers' Names, &c., on Newspapers;* Edward P. Day, City of New York.

Claim.—"What I claim is, the type cylinder, having a series of type grooves cut in its periphery and parallel to its axis, and binding screws in the cap or end plate of the cylinder, for adjusting the type in the cylinder grooves, in combination with the table platen and ratchet wheel for holding the paper and printing and rotating the cylinder, as an improvement on Henry Moeser's invention for like purposes, and whereby all the names of a subscription list for one post office, and the address of the post office, may be printed at one operation."

26. For an *Improvement in Whiffle Trees;* Francis M. English, Hopkinsville, Ky.

Claim.—"What I claim is, the arrangement of springs on the ends of swingle trees for holding the traces on the darts, and throwing off the same at the will of the driver, as fully set forth."

27. For an *Improved Lubricator;* Robert M. Wade, Wadesville, Pennsylvania.

Claim.—"What I claim is, the hollow cylinder, in combination with the jacket, constructed and operated as set forth, namely, the two apertures in the cylinder being so situated that while the upper one is admitting oil into the cylinder the lower one is closed to the steam, and when the lower aperture is open to the steam the upper one is closed to the steam and to the oil in the cup."

28. For an *Improvement in Steam Generators;* Alexander B. Latta, Cincinnati, Ohio.

Claim.—"What I claim is, the dividing of the coil or coils, commencing with one, then dividing into two, and then sub-dividing into four, or any other number, as described, or any equivalent device."

29. For an *Improvement in Sofa Bedsteads;* Charles F. Martine, Boston, Mass.

Claim.—"I claim the windlass barrel and its working gears, or their equivalents, and the cords of said windlass barrel, in combination with the seat, the back, and a single spring mattrass, as applied thereto, the whole being applied together and made to operate substantially in the manner specified."

30. For an *Improved Eyelet Machine;* Hymen L. Lipman, Philadelphia, Penn.

Claim.—"I lay no claim to the devices described, when taken separate and uncombined; but what I do claim is, the arrangement in one stock, of the double-acting lever, punch, and fastener, with their spiral springs and counter dies, or anvil block, for the purpose of punching holes for and setting eyelets in one machine, as set forth, and this I claim when said lever actuates both punch and fastener, by allowing one to rise, whilst the other is being forced down, as represented."

31. For an *Improvement in Excavator;* Elijah Phelps, Hendersonville, Illinois.

Claim.—"I do not claim scoops, supported by side wheels, such as have been used before; but what I do claim is, the combination of the wheeled scoop with the castor wheels, operating as set forth."

32. For an *Improvement in Seed Planters;* Wm. B. Johnson, Staunton, Virginia.

Claim.—"I do not claim said grooved semi-cones, or their equivalents, separately and apart from the other devices specified and used in combination therewith by me, as I am aware that their equivalents have been used before by F. Vandonen, and are described in the specification of his seed planter, patented 13th of April, 1852. What I claim is, the method described, of sowing seed broadcast by means of the ascending and descending buckets, grooved semi-cones, or their equivalents, and reciprocating bed or table, constructed, arranged, and operating together, substantially as specified. Also, constructing the seed buckets with an open back, false or close adjustable inner back, for regulating the lifting capacity of the buckets, as set forth."

33. For an *Improved Water Level Indicator for Steam Boilers;* Pat. Clarke, Rahway, New Jersey,

Claim—"What I claim is, the arrangement of the tube in relation to the chamber, in connexion with the boiler, whereby, through the action of the steam and water in the chamber upon the steam in the tube, the water in the tube is made an indicator of the height of the water in the boiler, or made to operate a valve in the feed water pipe, substantially as described."

34. For an *Improvement in Feathering Paddle Wheels;* Thos. Champion and Samuel Champion, Washington, District of Columbia.

Claim.—"What we claim is, 1st, The bowing or arching of one, two, or more of the shanks of the paddles, so that they may pass through the hub and stand in the same transverse line with each other round the wheel with the paddles on each end of each shank, permanently at right angles to each other, whereby the great advantages above mentioned are attained, and the wheel greatly simplified. 2d, Giving the shifting guides a side motion, just sufficient to disengage them from the projections of the paddles from one side of the hub, and simultaneously engage them with projections on the other side of the hub, and vice versa, so as to effect the proper adjustment or shifting of the paddles, and whereby we dispense with the inconvenience of having to turn the frame around to the opposite side of the wheel to shift the guides."

35. For an *Improvement in Seed Planters;* Waitman Davis, near Morgantown, Va.

Claim.—"What I claim is, the operating of the seeding bar of seeding machines, by means of a bell crank and lever, when said lever receives its motion from the leg of the operator in the act of walking, substantially as set forth."

36. For an *Improvement in Apparatus for Filing Mill Saws;* John Sheffield, Pultneyville, New York.

Claim.—"What I claim is, the arrangement of the stirrups, cords, weights, and rollers for holding, guiding, and supporting a file whilst filing a saw in the gate or frame, substantially in the manner represented."

37. For an *Improvement in Gold Amalgamators;* Robert H. Collyer, City of N. York.

Claim.—"What I claim is, the effecting the amalgamation of the gold, or other metal, and the separation of the ores, or other foreign matter, by means of a cylinder or cylinders, fluted to form buckets, or otherwise provided with such buckets, and revolving within a concave trough, or concave troughs, which contain the necessary quantity of mercury, said cylinders operating in the manner substantially described."

38. For an *Improved Lath Machine;* Isaac R. Shank, Buffalo, Virginia.

Claim.—"I claim the revolving gauge formed of two unequal cylindrical segments, in connexion as described, with a reciprocating knife, for the purpose of gauging and insuring the liberation and discharge of the lath."

39. For an *Improved Method of Operating Saw Mill Blocks;* David Russell, Drewersburgh, Indiana.

Claim.—"What I claim is, the combination of the transverse racks, the wheel, and the shafts, with the horizontal connecting piece and its racks, substantially as described."

40. For an *Improved Lathe;* Harrison O. Clark, Worcester, Massachusetts.

Claim.—"I do not claim the sliding rest, or the V shaped knife, or the side cutters, singly, or the bushings, except when used in combination described for the purpose above mentioned. What I claim is, 1st, The knife, in combination with the slide operating in

a straight line to and from the centre, or nearly so. 2d, The movable bushings applied to all the different sized cylinders required."

41. For an *Improvement in Weaving Cut Pile Fabrics;* T. Crossley, Boston, Mass.

Claim.—"What I claim is, the described method of weaving a cut pile fabric, that is to say, interweaving the pile into the body of the cloth by looping it over a shot of filling on the top of the foundation warp, and under a shot of filling under the foundation warp, in the manner described."

42. For *Cleansing Bolts of Flouring Mills;* William Cann, Black Rock, New York.

Claim.—"What I claim is, the application to flouring bolts of a brush or cleaner, as described, which will prevent the bolts of flouring mills from becoming clogged up with and obstructed by 'beards' and other substances which are contained in almost all wheat, and which will keep the bolts clean and free without the necessity of 'shaving' and 'brushing' the bolts, using for that purpose the aforesaid cotton, woolen, or other cloth, or other flexible material, substantially the same, and which will produce the desired effect."

43. For an *Improvement in Grinding Mills;* Edward Harrison, New Haven, Conn.

Claim.—"I am aware that a disk-faced running mill stone has been supplied with a metallic back and eye, when the said runner has been suspended upon a bail, and the grain fed through the eye of the same; and that a small sized running mill stone without a metallic back and eye, has been rigidly secured to its spindle, and therefore I do not claim either of the said arrangements; but what I do claim is, forming the runner of a metallic back and hub combined with a disk grinding face composed of the requisite quantity and quality of stone, and rigidly securing the shaft within the metallic hub of the runner, when the said runner is arranged and operates with the stationary uppermost stone, substantially as set forth."

44. For an *Improvement in Securing Car Wheels upon Axles;* J. L. Mott, City of N. Y.

Claim.—"What I claim is, the method of securing railroad car wheels to their axles by means of a nut, or the equivalent therefor, within the wheel, as set forth."

45. For an *Improvement in Joint Bodied Buggies;* Edwin J. Green, Cedarville, N. Y.

Claim.—"I do not claim a joint bodied buggy with a spring under the seat, as that has been described in the patent of James C. Spencer, of the 27th May, 1851. Nor the invention of a spring reach which shall allow the separation of the front and rear axles to a certain extent, and then act as a tie to prevent their further separation, as the patent of C. H. Guard, of June 10th, 1851, embraces a spring reach which performs this office; nor a spring reach with one point of connexion on the centre of the front axle, and two points of connexion equi-distant from the centre on the rear axle, as this is embraced in the patent of Starr Fairchild, of the 18th January, 1848; but what I do claim is, the combination of a spring reach of the peculiar form and construction, as described, with a joint bodied buggy of the form and style of that patented by James C. Spencer, by means of which greater strength is given to the buggy, and an easy and elastic seat given to the driver, with less expense and greater simplicity than has been hitherto used for like purposes."

46. For an *Improvement in Hay Presses;* Levi Dederick, Albany, New York.

Claim.—"What I claim is, traversing the follower parallel by two sets of levers or toggle joints, with one lever of each set extending beyond the joint of connexion, so as to form a lever to operate the joints when they are so arranged that the lever of the lower set or joint may work or vibrate between the fulcrum levers of the upper one, the two levers being connected together by a rod or links, the whole being constructed and operated substantially as described."

47. For an *Improvement in Moulding Hollow Ware;* James J. Johnston, Allegheny, and James V. Cunningham, Pittsburgh, Pennsylvania.

Claim.—"What we claim is, the arrangement of the fallow board, case box, and anchor, operated as set forth."

48. For an *Improvement in Grinding Mills;* John C. Reed, Assignor to C. P. Buckingham and Henry P. Upton, Mount Vernon, Ohio.

Claim.—"What I claim is, 1st, The hollow spindle, in combination with the metallic

cup, through which the grain to be ground is fed, substantially as specified. 2d, The method of balancing and adjusting the bed stone by means of adjustable weights, arranged in radial guides and movable towards and from the centre of the stone, as described."

49. For an *Improvement in Drying Flour;* Hervey Ely, Assignor to Samuel P. Ely, Rochester, New York.

Claim.—"What I claim is, 1st, Closing the cylinder or other conveyors at each end, or causing them to revolve in close boxes, as described. 2d, Applying to the exterior surface of closed cylinders, continued currents of heated air, so regulated as to keep the contents of the cylinders at a given temperature by an arrangement of dampers, and the observation of the thermometer attached, as set forth."

50. For an *Improved Blowing Fan;* Thomas Wallace and Elizabeth Backmeister, Administratrix, of Henry Backmeister, dec'd., Philadelphia, Pennsylvania.

Claim.—"We do not claim any improvement in the outside casing of a fan, nor in the means and apparatus by which rotary motion is produced; but we do claim the cylindrical revolving diaphragm, with one or more openings for the escape of the air by the combined action of centrifugal force and a vacuum, substantially as set forth."

51. For an *Improvement in Cooking Range;* Dennis Donovan, (for himself and as Administrator of Mitchell G. Hallman, deceased,) Assignor to Henry J. White, Philadelphia, Pennsylvania.

Claim.—"What we claim is, the hinged flue cover consisting of the hinged cover, side pieces, flue spaces, top flue, in combination with the valves or dampers. Also, in combination with the hinged cover and the valves, the arrangement of the aperture, for the escape of fumes from cooking. Lastly, the sliding boiler plates, in combination with the hinged cover and valves or dampers."

52. For an *Improvement in Making Car and other Wheel Tires;* Alfred Krupp, Essen, Prussia.

Claim.—"What I claim is, the making the tires for railway car and other wheels, out of solid bars of cast steel, without welding, slotted, opened, expanded, and finished into the desired shape, in the manner described."

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53. For an *Improvement in the Manufacture of Sulphuric Acid;* Dominique Emile Coutaret, Roxbury, Massachusetts; patented in England, December 16, 1852.

Claim.—"What I claim is, the mode of bleaching and purifying (without loss or injurious emanations,) sulphuric acid from the leaden chambers, by means of the movable cover plunging into the liquid sulphuric acid contained in the boiler, and receiving by the tube the sulphurous gas of the furnace, leaving the surplus to escape by the tube, which arrangement constitutes a new and complete apparatus, whereby is obtained by chemical reaction the bleaching and purification of the sulphuric acid as drawn from the leaden chambers, while it avoids the loss of the nitrous gas, and the before stated inconveniences arising therefrom. Also, the improved mode of concentrating sulphuric acid to sixty-six (66) degrees, without loss or injurious emanations, by means of the movable cover or capital, surrounded by a gutter adapted to the leaden evaporating boiler."

54. For an *Improvement in Threshers;* Wm. Russell Palmer, Elizabeth City, N. C.

Claim.—"What I claim is, 1st, The peculiar form and construction of the furrowed surfaces of the flanches and rubbers, as described. 2d, The combination of such rubbers which are adjustable with such flanches and their arrangement, as described, upon the opposite sides of the flail case, and also the combination of such furrowed rubbers and flanches, substantially in the manner set forth, with the rotating flails."

55. For an *Improvement in Nail Plate Feeders;* Joseph Iler and William Fitzpatrick, Troy, New York.

Claim.—"We do not claim the revolving cylinder through which the nail plates are fed, as that device is not new, and is to be found in several devices for the purpose; among others, it will be found in the patent granted to Caleb Isbister, dated the 31st December, 1844. We claim, 1st, Giving a rising and falling motion to the end of the nipper barrel and nose pieces attached thereto, by means of the cam, bearing, and guide

saddle, in combination with the nipper barrel, substantially in the manner as described. 2d, Constructing the nose pieces with an opening between them so as to permit the jaws of the nippers passing into this opening for the purpose of feeding the scrap end of the nail plate as close up to the cutter as possible, thereby leaving less scrap iron. 3d, The guide and spring, in combination with the nose pieces, for the purpose of guiding and holding the nail plate in the nose pieces, as described."

56. For an *Improvement in Bed Bottoms;* Tyler Howe, Cambridgeport, Massachusetts.

Claim.—"What I claim is, the combining the main springs together and with the frame in lateral directions by means of wire and clasps, in combination with connecting said springs at their ends in such frame by means of rocker blinds, all substantially as specified, and for the purpose of forming a mattrass foundation of bar springs, whose parts shall readily accommodate themselves to the various strains induced by a person's body when laid upon them, and this without injurious strain upon one another."

57. For an *Improvement in Operating Cut-off Valves for Steam Engines;* Thomas Ashcroft, Dorchester, Massachusetts.

Claim.—"What I claim is, controlling the operation of the cut-off plates or valves, by means of two inclined planes, one attached to each valve and the movable stop bar, the whole being constructed as described."

58. For an *Improvement in Cast Iron Car Wheels;* David Prew, Taunton, Mass.

Claim.—"What I claim is, my improved cast metal chilled rim wheel, as made of the combination of a solid or tubular hub, a chilled rim, two undulating plates uniting the hub and rim, a series of ogee or curved arms, (placed between the hub and rim and two plates, and made to connect the hub and rim, and be joined throughout their entire length to the two plates,) and a series of openings in one of the plates, and respectively between the arms, all cast or founded in one piece of metal."

59. For an *Improvement in Spark Arresters;* Casimir Abos, New Brunswick, N. J.

Claim.—"What I claim is, the combination and arrangement of the draft pipe, central spark conducting or return pipe, hinged self-closing valve and stack, substantially as described."

60. For an *Improvement in Insulating Telegraph Wires;* John M. Batchelder, Cambridge, Massachusetts.

Claim.—"What I claim is, the combination of an electric telegraph wire or conductor, with a composition of india rubber and sulphur, forming an insulating coating upon and around the wire, this composition being the same for which a patent was granted to Nelson Goodyear, on the 6th day of May, 1851, and herein referred to."

61. For *Improvements in Stills for Distilling Fatty Bodies;* S. Childs, City of N. Y.

Claim.—"I claim, 1st, The use of a stratum of steam within a jacket or case between a fire heat and a vessel containing any article, such as those named above, under treatment, whereby the heat applied to said vessel can be any desired amount, and the same can be regulated to any desired point, according to the supply and delivery of the steam, as specified. 2d, Passing the steam from a jacket, as set forth, directly into the still and material under treatment, as specified."

62. For a *Lens Lamp Chimney;* Silas Constant, Brooklyn, New York.

"The nature of my invention consists in constructing that part of a lamp chimney which surrounds the flame in the form of an annular lens, for the purpose of so directing the rays of light from their natural course, as to concentrate and project them in any desired direction."

Claim.—"What I claim is, constructing a lamp chimney with the bulge so thickened as to form an annular lens for refracting the rays of light."

63. For an *Improvement in the Construction of Tanning Apparatus;* Nath'l. Dodge, Orford, New Hampshire.

Claim.—"What I claim is, the combination of the two dashers and sets of notch bars, as applied to the two vertical and movable frames and in the vats, and made to operate essentially in the manner as set forth."

64. For an *Improvement in the Construction of Accordeons;* A. Faas, Philadelphia, Pennsylvania.

Claim.—"What I claim is, combining with the diatonic scale of the large keys two

other scales, viz: one for producing all the intermediate notes or semi-tones, and the other founded upon the subdominant of said diatonic scale, and both arranged so as to be fingered by a single set of small keys, for the purpose of enabling the instrument to produce full and correct harmony in any key. Also, providing the accordeon with a sound-board, for the purpose of producing more strength, fullness, and resonance of tone with the instrument."

65. For an *Improved Carriage Axle;* Eli H. Green, Baltimore, Maryland.

Claim.—"I do not claim the mere axle with a shifting sleeve; but what I do claim is. the construction of axles for carriages, wherein the arms and intermediate bar shall be of wrought iron, and the arms thereof formed of eight or more sides fitting into a corresponding hollow of a cast sleeve, the surface of which may be turned for a bearing, in the manner described. Also, the combination of the cast sleeve carrying the huster with the mail coach patent box, for the purpose of obviating the necessity of cutting the axle to remove the broad washer."

66. For an *Improved Printing Press;* George P. Gordon, City of New York.

Claim.—"What I claim is, 1st, The employment or use of a rotating reciprocating fly, arranged substantially as shown, for the purpose of relieving or removing and piling the sheet after it is printed. 2d, Giving, with one inking cylinder, two distributions to the inking rollers for each impression, viz: one prior to the passing of the form, and one prior to the repassing of the form. 3d, The combination of the spiral spring connecting rod and crank motion with the stops for operating a bed or carriages during the time the impression is made, the above parts being arranged as shown."

67. For an *Improvement in Tail Boards of Wagons;* F. M. Harris, Carroll, Ohio.

Claim.—"What I claim is, the manner of rendering the tail-gate or board capable of increasing the length of the body of the wagon when lowered to a horizontal position. I also claim the combination of the spring catches, eye-strap, hinged tail-board, elbow shaped pieces, and hooks, for the purpose of rendering the tail-gate self-locking, and also capable of resting in a horizontal position while unloading."

68. For an *Improvement in Bed Bottoms;* Berryman R. Hundley Lynchburgh, Ohio.

Claim.—"I claim the ring provided with hooks or other attachments for the cords, in connexion with a handle and catch, substantially as described, for the tension of a radial arrangement of the bed cord."

69. For *Improved Vises;* Bernard Hughes, Rochester, New York.

Claim.—"What I claim is, the method of attaching and using the nut or female screw at the back of the movable jaw, with simple screws through its flanch."

70. For an *Improvement in Saddle Trees;* William E. Jones, U. S. Army.

Claim.—"What I claim is, the introduction of a hinge into the pommel, and one into the cantle, in connexion with screws, by means of which the saddle can be made to enlarge and contract, and thus to fit any horse."

71. For an *Improvement in Winnowing Machines;* J. Keech and S. Stillwell, Waterloo, New York.

Claim.—"What we claim is, the movable trunk, for the purpose of converting the open horizontal blast of the ordinary winnowing machine into a vertical blast separator."

72. For an *Improvement in Making Card Teeth;* Wm. Montgomery, Roxbury, Mass.

Claim.—"I do not claim to make card teeth of wire; but I do claim the making of each two teeth and the base thereof, of a metallic plate formed and bent in the manner described."

73. For an *Improvement in Exhaust Fans;* J. V. Merrick, Philadelphia, Penna.

Claim.—"I do not claim the use of suction blowers for increasing draft in a chimney, as this has been long known, but claim the combined arrangements of the valves, L, M, N, O, and the external exhaust blower, E, E, operating in the manner described."

74. For an *Improvement in Printers' Friskets;* Andrew Overend, Philadelphia, Pa.

Claim.—"What I claim is, the construction of movable barred frisket frames by the combination of elastic bars, clamps, and toothed frisket frame, arranged as described."

75. For an *Improvement in Operating Valves of Steam Pumps;* Charles A. Wilson, Newport, Kentucky.

Claim.—"What I claim is, the double weighted lever, having one fixed and one jointed weight, as described, for opening and closing the valve instantaneously, without a rebound at the end of each stroke of the piston. Also, connecting the slotted rod, or its equivalent, with the valve, by means of the weighted lever and the jogs on the valve, to allow the valve to remain stationary until the piston is at the point of finishing its stroke, and then instantly opening and closing them by the weighted lever, the lever turning freely on its fulcrum, causing no motion of the valve thereby."

76. For an *Improvement in Coupling;* Martin Newman, 2d, and N. C. Whitcomb, Lanesboro', Pa., and G. C. Cole, Hartford, Connecticut.

Claim.—"What we claim is, the application of the spring button, operated in the manner set forth."

77. For an *Improvement in Mills;* David L. Latourelle, St. Louis, Missouri.

Claim.—"What I claim is, the combination of the revolving wheel, with a roll or rolls, or with a block or blocks, or their equivalents, arranged in any of the ways or for any of the purposes set forth."

78. For an *Improvement in Harvester Cutters;* Bronson Murray, Farm Ridge, Assignor (through T. R. Spencer, Geneva, N. Y.,) to John S. Wright, Chicago, Ill.

Claim.—"I do not claim any particular form for the irregular or angular shaped back, or any particular for the front cutting edge of the sickle; but I claim making the rear curvatures of the sickle blade, sickle-edged, except the rear projecting points, which latter construction I disclaim, as being the invention of Henry Green."

79. For an *Improved Mode of Closing Wickets in Canal Gates;* David N. Knownover, Danville, Assignor to Richard L. Knownover, Milton, Pennsylvania.

Claim.—"What I claim is, attaching an arm with roller to wicket rods of canal lock gates, by which means the wicket will close when the gate is opened, as specified."

80. For an *Instrument for Trimming Welts of Boots, Shoes, &c.;* Lyman Clark, Assignor to L. Clark and Joseph Sawyer, South Royalton, Massachusetts.

Claim.—"What I claim is, the welt knife, constructed in the manner set forth."

81. For an *Improvement in Adjustable Rails for Replacing Cars on the Track;* Chas. Perley, City of New York.

Claim.—"I claim connecting an inclined grooved rail to a shoe or box setting on the railroad track by means of a joint, or to an intermediate section or sections, so that said grooved incline can be turned to any position to coincide with the flanch of the wheel and replace the same on the track."

82. For an *Improvement in Chain Cable Stoppers;* Charles Perley, City of N. York.

Claim.—"I claim the method of hinging and sustaining one or more pawls on an inclined hinge or hinges attached to the chock, to clamp or stop a chain cable between said pawl or pawls, and the chock or plate on the deck, in the manner specified."

83. For an *Improvement in Crushing and Grinding Quartz and Minerals;* Samuel Perkes, Walbrook, England; patented in England, 12th October, 1852.

Claim.—"I do not claim any of the parts, when separately considered; but the combination of the vessel, the trough, the conical crushing rollers, the hollow axis, and the arrangement for supplying water, as described."

84. For an *Improvement in Railroad Car Odometers;* M. F. Potter, Charlemont, Mass.

Claim.—"I do not claim transferring the motion of the axle by means of the endless screw; but I do claim the arrangement by which the pinion upon the upright shaft attached to the car, is adapted directly to the axle itself, so that while the rotation of said axle causes a revolution of the pinion through the endless screw, the endwise movement of the axle in turning curves, acts upon the pinion so as to move it independently of the rotation of the screw, in the same or opposite direction, according to the course of the curve, the screw exceeding in length the arc of the circle through which the axle would move."

85. For an *Improvement in Bridle Bits;* Ebenezer N. Price, Salem, Massachusetts.

Claim.—"What I claim is, the improvement of making the bit, or providing it with the nippers or jaws, made to operate against the jaw or under lip of a horse, as specified. And in combination with the nippers or jaws, I claim the strap as applied to him, and made to operate with them, not meaning to claim a strap, or its equivalent, separate from the jaws, nor the application of such to the bars of a common bit, but to combining it directly with the nippers, so as not only to keep them from spreading outwards, but to preserve the bit in place, or prevent it from rising too high in the mouth of a horse."

86. For an *Improved Device for holding Pieces in Spoke Machines;* I. Starks, Genoa, and L. Perrigo, Grafton, New York.

Claim.—"What we claim is, the manner of holding and operating the spoke in the carriage, so that upon slackening the tail screw at the one end, the spoke is forced backwards and made capable of being turned without disturbing it from its centres, and is restrained from turning when set, by means of the sliding and turning socket bar in the head stock, provided with a clamp head fitting in a V, or other suitably shaped recess in the head stock, and the socket bar with its clamp head forced backwards by a spring, or its equivalent, whereby great expedition and truth is insured in turning and setting the spoke."

87. For an *Improvement in Carriages;* James L. Rowley, Steuben County, Indiana.

Claim.—"What I claim is, the employment of a spring reach, in combination with the swivel joint on the front end of the same, in the manner set forth."

88. For an *Improvement in Harvesters;* Ira Reynolds, Republic, Ohio.

Claim.—"What I claim is, 1st, The arrangement of a double series of double-edged shear blades, supported at their rear ends by the reciprocating bars to which they are pivoted, and regulated by temper screws, as described. 2d, The grain gatherer, so arranged that its forward portion can be elevated or depressed from the driver's seat without stopping the machine."

89. For an *Improvement in Processes for Hardening Tallow;* C. Schinz, Camden, N. J.

Claim.—"What I claim is, the use of either the nitrate of ammonia alone, or conjointly with sulphite of ammonia, for the purpose of hardening fats used for the manufacture of candles, as described, and which will produce the intended effect."

90. For an *Improved Steering Apparatus;* John Stowell, Charlestown, Mass.

Claim.—"What I claim is, the application of the curved sectoral rack and the rest of the steering mechanism directly to the rudder head, so that such can rise with and be elevated or depressed by such rudder head, in combination with supporting the rack upon the deck by posts formed with shoulders, as described, or by such contrivances as will not only prevent it from moving laterally in a horizontal direction, but permit it to rise upwards with the rudder head."

91. For an *Improvement in Steam Boilers;* Peter Sweeney, Buffalo, New York.

Claim.—"What I claim is, dividing the interior of the boiler by an annular casing filled with non-conducting material, or by a non-conducting tube, formed in any convenient and suitable manner, so as to form an external water space which exposes a thin body of water to the action of the fire, and an inner or central cylinder, in which the water is kept at a comparatively low temperature."

92. For an *Improvement in Buckles;* Wm. Shove, Elizabethport, New Jersey.

Claim.—"I am acquainted with the device of uniting the two ends of a buckle by bringing them together in bosses, which are kept together by a corresponding cavity in the clue of the tongue, and therefore I do not claim the broad device of uniting the two ends of the buckle by a joint, which is kept closed by a peculiar tongue; but I do claim, making the union by a common dove-tail joint, which of itself resists tension lengthwise, and which requires only the common tongue to hold it in permanent connexion. The advantage of the above improvement is, that the bow is made equally as strong and durable as the soldered or brazed ones, and with much less expense."

93. For an *Improvement in Locking-up Printers' Forms;* E. H. Sprague, Zanesville, O.

Claim.—"What I claim is, the manner of setting and locking or unlocking the 'form' in the 'chase' by means of the tapering bar, with the intermediate wedges extending lengthwise and crosswise of the 'chase' on the side and end thereof, and operated by

hand lever, as specified, whereby the usual sticks and quoins are dispensed with, and the many other advantages are obtained."

94. For an *Improvement in Tightening Windows;* Thos. Silver, Philadelphia, Pa.

Claim.—"What I claim is, the swell or lateral bearing, in combination with the oblique base, applied in the manner described."

95. For an *Improvement in Operating Bolts and Locks for Controlling Series of Doors;* David J. Stagg, Hoboken, New Jersey.

Claim.—"I claim, in combination with double throw lock bolts, or double acting lock bolts on the doors, as specified, the sliding hasps, constructed and attached to, and operated by the system of bolts, as set forth."

96. For an *Improvement in Spark Arresters;* G. B. Simonds, New Haven, and Abel Breaer, Saugatuck, Connecticut.

Claim.—"What we claim is, 1st, So arranging the conical deflector in the upper part of the case, and in relation to the flanch which is around the draft opening, and extends down inside from the top of the case, that the exhaust steam will be caused to act upon the sparks, and force them into their chamber, and form a screen between the inverted base of said cone and the lower edge of the flanch, and thereby serve most effectually for preventing the sparks rising and escaping through the draft opening when it is desired to retain them in the case. 2d, In the employment of the elliptical shaped cone within the elliptical case, in combination with the spreaders. We also claim regulating the escape of the sparks by means of the adjustable flanch, arranged around the discharge opening."

97. For an *Improvement in Feed Water Apparatus to Steam Boilers;* H. C. Sergeant, Cincinnati, Ohio.

Claim.—"What I claim is, 1st, The combination of the balance valves, the float, and the valve, all arranged within, or applied in any manner to a box, connected as described, with a boiler and a reservoir. 2d, The cup, sunk below the pipe, which supplies the box with water, or otherwise applied inside of the valve for the purpose of receiving and retaining a small quantity of water every time the box is charged, for the purpose of facilitating or expediting the condensation of the steam after the water has been discharged from the box."

98. For an *Improvement in Compositions for Coating Telegraphic Wires, and for other Purposes;* Thomas, Earl of Dundonald, London, England; patented in England, 6th October, 1852.

Claim.—"I do not claim the use of native bitumen or asphaltum for any of the purposes to which it has heretofore been applied; nor any cement made therefrom by mixtures, as heretofore used; nor the covering of textile fabrics with any combination of bitumen or asphaltum; but I do claim the combination of gum shellac, rosin, tar, the unctuous oils, or the viscid oil of coal tar, bitumen, asphaltum, or mineral pitch and india rubber, for the coating and insulating telegraphic wires, and for other purposes."

99. For an *Improvement in Soap Compounds;* T. Chalkley Taylor, Camden, N. Jersey; patented in England, September 17, 1853.

Claim.—"What I claim is, the dissolving of the bran of cereal grains in caustic alkali, and using the product as a substitute for, or as an ingredient in, the manufacture of soap, as described."

100. For an *Improvement in Soap Manufacturing Processes;* T. Chalkley Taylor, Camden, New Jersey.

Claim.—"I am aware that potatoes and other similar bulbous or vegetable materials, divested of their skins, boiled and mashed, or otherwise prepared or manufactured so as to involve a loss of the skin, have been used as ingredients in the manufacture of soap; this I do not claim; but I do claim the process herein described, of treating, by alkali in a cold or tepid state, potatoes with their skins on, in the manner set forth."

101. For an *Improvement in Securing Tools to their Handles;* Anthony Vittaly and Carl Kolb, Newark, New Jersey.

"The nature of our invention consists in securing the tools to the stock by means of a screw metal shoulder, or block and dowel pin."

Claim.—" What we claim is, securing the tool to the stock or handle, by means of the screw rod, block or collar, and dowel pin, constructed and arranged as set forth."

102. For an *Improvement in Looms;* George Yates and Eli Clayton, Lancaster, Pa.

" The nature of our invention is, a grooved shuttle having a groove with edge to slide in a corresponding groove with edge formed on the lathe cap, between the reed and lathe cap, which we style the 'operatives' protector.' We are aware that the patent granted to H. T. Robbins, on the 14th of September, 1852, for an improvement in shuttle guides and looms, which is mainly intended for the same purpose as that aimed at by us."

Claim.—" What we claim is, a mere improvement upon the contrivance of the said Robbins, and which consists in the grooved shuttle, in combination with the grooved lathe cap, as described."

103. For a *Railroad Car Ventilator;* John Bevan, Jersey City, New Jersey.

Claim.—" What I claim is, arranging on either side of a suction fan blower, and on the same shaft with the same, a series of revolving separating blades, or their equivalents, for the purpose of creating a strong revolving current of air above the top of the car, which acts centrifugally upon the cinders, dust, and other heavier particles than air accompanying the current created by the rapid motion of the cars, and causes them to be deflected and fall to the ground, instead of entering the car, while the fan blower acts centripetally upon the air thus separated or stripped of its impurities, until it enters the blower, and then causes it to pass into the car, and ventilate the same agreeably and in a very perfect manner, the whole being constructed, arranged, and operated in the manner described."

104. For an *Improvement in Steam Boilers;* James Wightman, Pittsburgh, Penna.

Claim.—" What I claim is, the arrangement of the arch or roof of the fire-box extending through to the up-take, and connecting with a counter arch, in such manner as to form an elliptical flue to form a communication between the furnace and up-take, in connexion with a series of small return flues above the roof of the fire-box and elliptical flue, and in a curve concentric therewith, so that the upper side of the highest flue will be at the same distance, or thereabouts, below the upper surface of the water within the boiler, whether the latter be upright, as when a vessel on which it it placed is on an even keel; or inclined, as when the vessel is careened, as set forth."

105. For an *Improved Canal Lock Gates;* George W. Wood and Lucius O. Webster, Utica, New York.

Claim.—" What we claim is, 1st, The hooked form of the levers and the curving of the shackle bars, as described. 2d, The adjustable lever box above described, including the mode of adjusting the valve rods and tightening the valve gates by the use of the screws, or their equivalents. 3d, Also, the combination of the hooked levers with the curved shackle bars, and the adjustable lever box, the whole being constructed and arranged in the manner set forth."

106. For an *Endless Chain Horse Power;* G. Westinghouse, Central Bridge, N. York.

Claim.—" The mode of gearing by internal gear and pinion I have adopted is old, and has been long in use; but the peculiar construction of the parts of it, is my invention; therefore, what I claim is, the construction of the gearing, substantially as set forth, having a pinion permanently affixed on the ends of each shaft, to either of which the hubs of either the driving or band wheels fit and are fastened."

107. For an *Improvement in Machinery for Napping Cloth;* Jos. Weight, Lawrence, Massachusetts.

Claim.—" I do not claim the employment or use of cards for napping cloth, irrespective of the peculiar arrangement, for cards have been previously used; but what I claim is, the combination of the endless card sheet and endless transverse card belt, the above parts being arranged and operating in the manner described."

108. For an *Improvement in Machinery for Spinning Wool;* Edmund Victory, Assignor to D. M. Linsley and George Goulding, Watertown, New York.

Claim.—" I do not claim, of themselves, the employment of drawing rollers, revolving with the head, and made, in addition, to rotate at a suitable velocity on their own axes, for the purpose of drawing and twisting the sliver or thread, as such have before been used; but what I do claim is, arranging the drawing rollers to operate in the manner specified, within the revolving tube or head, while the head is sustained by a sufficient bearing on the whole circumference outside of the said rollers, as shown and described,

whereby the double movement of the drawing rollers on their own axes, and with the head, is rendered perfectly steady, and the vibration prevented, which tends to produce an uneven thread."

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109. For an *Improved Veneer Polisher;* Edwin Allen, South Windham, Connecticut.

Claim.—"I do not claim the belts, separately, for belts or their equivalents have been previously used for similar purposes; but I claim the combination of the belt and pressure cylinder, constructed, arranged, and operating in the manner set forth."

110. For an *Improvement in Metallic Grommets;* John Allender, New London, Conn.

Claim.—"I claim making that portion of the tube put through the ring to correspond, or nearly correspond, with the corners of the canvas or cloth, so that when they are bent down upon the canvas they double or bend it over the edge of the ring, and confine it firmly, substantially as described. 2d, Is the scores in the ring, which correspond or nearly correspond with the corners of the cloth and with the points of the tube, in combination with the points of the tube, as described. 3d, Scoring, or otherwise roughening the surface of the rings where they come in contact with the cloth, so as to make them hold the canvas firmer and better. 4th, Making or inserting points in or on one or both of the rings to extend through the canvas into the opposite ring, or otherwise. 5th, Riveting the points of the tube which are bent over on the cloth, or otherwise, substantially as described."

111. For an *Improvement in Quartz Crushers;* D. C. Ambler, City of New York.

Claim.—"I claim, 1st, The combination of a revolving trough with balls located therein, said balls being attached to shafts, substantially as described, and having further imparted to them a pendulous bounding motion, substantially in the manner specified, whereby qnartz or other similar substances may be stamped, crushed, and pulverized in the same machine. 2d, The combination of a revolving trough with balls revolving therein by friction; but this I claim only when these balls are attached to shafts, substantially in the manner specified, whereby quartz, etc., may be pulverized and crushed, as specified."

112. For an *Improvement in the Setting of Steam Boilers;* D. C. Ambler, City of N. Y.

Claim.—"I do not claim the form of boiler described; neither do I limit myslf to the use of a boiler provided with only two heaters, as more might sometimes be advantageous; neither do I claim the method of distributing hot air, nor the protecting of steam surface by means of brick or tiles; but I do claim the method of setting a boiler, as described, in so far as the same consists in grate surface extending the whole length of the boiler, or nearly so, when the same is employed in connexion with a midriff, located substantially as described, and causing the products of combustion to travel in reverse directions. Also, tiles, shaped substantially as described, in connexion with bearers, shaped and located for the purpose of forming a midriff or division between the flues, as specified."

113. For an *Improvement in Processes for Treating Paint;* G. Blondin, City of N. Y.

Claim.—"As I have claimed the composition described, of albuminous paint powder, as a new manufacture, in an application for another patent, I make no claim to it here. What I now claim is, the hardening and fixing of paint, of which albumen is a constituent, by coagulating the albumen after the paint has been spread, substantially as set forth."

114. For an *Improvement in Paint Composition;* Gabriel Blondin, City of N. York.

Claim.—"I claim the composition of ingredients, described for the purpose specified."

115. For a *Method of Governing the Action of Valve Cocks;* Fred'k. H. Bartholomew, City of New York.

Claim.—"I claim the method, substantially as described, of controlling the motion of a valve by means of a variable chamber combined therewith, the said chamber having a small opening, or the equivalent, communicating into it, through which the chamber shall always fill or discharge, whereby the discharge of flow of water shall be governed in the manner described."

116. For *Improvements in Cut Nail Machines;* Thomas H. Barlow, Lexington, Ky.

Claim.—"I claim, in combination with the pairs of fixed stocks and cutters, when said vibrating stocks and cutters are so arranged as to be capable of being operated from one rock shaft, by one cam and lever, and the pairs or sets of stocks constitute the griping jaws for holding the blank whilst it is being headed, and thus dispensing with the usual

mode of griping, substantially as described. Also, in combination with the vertical oscillating nail plate holder, the escapement, or its equivalent, for the purpose of gauging and feeding up the nail to the cutters and gripers, substantially as described. Also, the operating of the nail plate holder from the heading levers, through the medium of the arms, sliding bar, lever, and escapement, or their mechanical equivalents, substantially as described."

117. For a *Flour Sifter and Renovator;* Mark S. Bassett, Wilmington, Delaware.

Claim.—"I claim the arrangement of the radial rollers and horizontal brushes with the coarse and fine sieves, for the purpose of renovating damaged and lumpy flour, in the manner set forth."

118. For an *Improvement in Grain Winnowers;* Joseph Bone, Warrington, Ohio.

Claim.—"I do not claim the mere separation of grain into several grades according to specified gravity by the action of the suction fan, and the arrangement of a single set of tubes, as such is well known; but what I do claim is, the arranging and connecting a series of two or more sets of separating passages, substantially as set forth, so that the grain may be carried through the entire series of separating passages as often as required by the operator, for thoroughly cleaning and separating the same, as specified."

119. For an *Improvement in High Pressure Steam Engines;* Benjamin Crawford, Pittsburgh, Pennsylvania.

Claim.—"I claim the method of producing a vacuum in condensing engines by allowing a part of the exhaust steam to escape into the atmosphere without resistance, by a flap valve, as described, before the condenser is opened, and then condensing the remainder by opening the communication between the cylinder and condenser, whereby the weight, bulk, cost, and expense of working the condensing apparatus are diminished, and the power and efficiency of the engine are increased, substantially as set forth."

120. For an *Improved Machine for Printing Woolen and other Goods;* Thos. Crossley, Boston, Massachusetts; patented in England, April 5th, 1854.

Claim.—"I claim the combination of the series of blocks with the stationary cases, or their equivalents, and the endless chain register, operating in the manner substantially as described, by which any number of colors may be simultaneously applied, and a section of the figure be completed each time the blocks are depressed. 2d, The method of holding and feeding the material to be printed, by means of the endless chain and hooks, by which the material is held rigidly until the operation is completed, and thus a perfect and unerring register is obtained. 3d, The method of giving motion to the blocks, by means of the sector, or its equivalent, whereby they are moved in with a slow motion, and out with a rapid motion, and are caused to remain stationary at the two extremes of their traverse, while they receive their color, and the impression is made."

121. For an *Improvement in Steam Engines;* Benj. F. Day, Philadelphia, Penna.

Claim.—"I lay no claim to the double engine, connected to cranks at right angles on one shaft; nor the principle of using steam expansively, in connexion with a cylinder or engine using it directly from the boiler, as these are described in the patent granted to Daniel Barnum, on the 19th September, 1846: neither do I claim the arrangement of valves as patented to said Barnum; but what I do claim is, in contra-distinction from allowing the steam to pass directly from one cylinder to the other, the taking of the steam from the receiving cylinder to a steam chest provided with valves and ports, by and through which the steam is admitted to, and exhausted from, the expansive cylinder, by which means I retain a longer expansive action of the steam, substantially as described."

122. For an *Improvement in Weaving Double Cloth;* Samuel Fay, Lowell, Mass.

Claim.—"I claim the manufacture of a fabric which has one face of wool, and the other of cotton or linen, substantially as described; that is to say, in no place does the warp, which is upon one side of the cloth, extend into the surface of the other side of the cloth."

123. For an *Improvement in the Construction of Reed Musical Instruments;* F. A. Gleason, Rome, New York.

Claim.—"I claim the hammer, arranged in each vibrating air chamber, in connexion with the wire spring and valve. Also, in combination with it, the vibrating air chambers under each reed, and the modulating air chambers, with the small apertures over the reeds, all arranged and operating as described."

MECHANICS, PHYSICS, AND CHEMISTRY.

For the Journal of the Franklin Institute.

An apparatus for Organic Analysis by Illuminating Gas, and on the use of this Gas in Experimental Laboratories. By Charles M. Wetherill, Ph. D., M. D.

[Note. I embrace an opportunity which I certainly would not have created, to say a few words in regard to Professors Alexander and Morfit's remarks in the April number of the Journal, especially as they seem to have misapprehended the nature of my criticism of their apparatus. This criticism was not called forth, because their method is not new; for, interesting as Truth and Justice are to all their lovers, the champions of the rights of others would, in our day, set for himself a task herculean if not quixotic. The motive was simply this; the process which they propose "for organic analysis *generally*," is contrary to the first principles of such analysis. This, however, is so plain to the merest tyro in the "profession," as not to require any remark; but I was desirous of describing Hess' process, which is considered to be a great improvement in organic analysis, and which, as far as I am aware of, has not, until very lately, been set forth in works in our language, to which students have access. Yielding credit to Mr. Hess was incidental to this. The combination of principles applied by Hess in this regard, are, substitution of alcohol for charcoal heat, drying the oxide of copper in the combustion tube, thus avoiding excess in the hydrogen determination, and burning the body in a tray in a current of oxygen, with precautions to insure perfect oxidation, and facilities for determining the ash, when there is any. Now, all of these are described by Professors Alexander and Morfit, with the exception of the use of oxide of copper, which cannot *generally* be omitted, as they will learn by an analysis of sugar, lignin, &c. Reference to my remarks will show that I admitted, that oxide of copper might be omitted sometimes, but *very rarely*. In fact, Dumas and Stas more than thirteen years ago determined the equivalent of carbon by the combustion of natural and artificial graphite and diamond in a current of oxygen, in precisely the manner of Alexander and Morfit. It is to be very much doubted whether a well characterized bituminous coal would yield accurate results by such a method. Reference was made to the position of the stop-cocks not to express an opinion, but to allude to Marchand's very important suggestion for regulating the current of oxygen.

It is customary for chemists, especially those careful of the rights of others, when describing a process involving such rights, to call attention to the fact. Neglect of this is always considered as a claim, the only excuse for which is, ignorance of such rights, and which is not always a thing to be ashamed of. I shall not hesitate to criticise whatever is contrary to the principles of organic chemistry, and incidentally to give credit where it is due. Those who know me will, I am sure, attribute no other motives than for the advance of the science, and the opinions of those who do not know me, are, in this respect, as valueless to me as mine are to them. If proper criticism and discussion are to the advantage of science, a mere war of words and personalities, is as much to its disadvantage as it is disagreeable.]

The application of illuminating gas to the manifold purposes of the laboratory, followed very soon its introduction into the larger cities; its application to Organic Analysis has been described in different chemical journals, of which those that I have seen, are as follows: In *Liebig's Annalen*, lxxiv, 115, Kühn describes, though not in any great detail, an apparatus consisting of a row of from twelve to fifteen four-holed burners, (i. e. such with holes at the corners of a square), each regulated by a stop-cock, by means of which an analysis in a current of oxygen gas by Liebig's method, was accurately performed at an expense of one-twentieth of a thaler, or about three cents and three mills for the gas.

Sonnenschein (Erdman and Marchand, *Journal*, lv, 479,) in an article

on the use of gas in chemical laboratories, describes an organic analysis apparatus by Hess' process, in which the gas is burned with air mixed by the intervention of wire gauze. The gas is admitted by three cocks to a rectangular somewhat pyramidal box of sheet iron, the bottom of which is open, and the top covered with brass wire gauze. Over the gauze are numerous covers, which may be held either open or closed, by springs similar to the portable inkstands in use here. By opening or closing these covers, the gas may be applied to any part of the combustion tube, or gradually from end to end.

Magnus (*Idem*, lx, 32,) describes an apparatus similar to the above, but different in the mode of regulating the issue of gas; which is effected by a tube pierced with a row of small holes upon its upper surface, and running the length of the rectangular box, at a distance below the wire gauze. Small covers with handles projecting below the box are placed upon the holes to prevent the issue of gas where necessary.

Beale's apparatus (*Pharm. Journal*, x, 9,) has a tube pierced with holes at the bottom of the rectangular box, similar to the last described, but with a piston, the drawing out of which enables the holes for the escape of gas to be successively opened. The said box has a movable partition, so that the compartment, where the mixture of gases takes place, can be enlarged gradually from front to back. The gas, mixed with air, burns above two layers of wire gauze, and a chimney admitting air at the bottom, completes the arrangement.

Hoffman, in the appendix of his English edition of *Liebig's Organic Analysis*, describes his apparatus, in which the gases are burned both free, and mixed with air, as follows: The process is that of Hess; the rectangular box covered with wire gauze, in which the air and gas are mixed, runs the whole length of the combustion tube, and is divided into three separate compartments. The first two of these are under the forepart of the combustion tube, and heat it by mixed gases, the remaining box is situated under the platinum tray containing the substance to be analyzed, its wire gauze cover is pierced with two rows of holes through which project very fine tubes, communicating at their other ends with a larger tube to which gas is admitted by a stop-cock, and in which slides a piston, by the drawing out of which gas flames may be lighted successively along the double row of tubes above the wire gauze. Another cock admits gas below the wire gauze, so that at this portion of the tube the heat may be made by free or mixed gas, independently of each other. The mode of heating is evident. The front part of the combustion tube is kept at a red heat by mixed gases, the substance is gradually heated by the small flames by drawing out the piston, and a red heat is obtained at this portion of the tube at the close of the analysis by mixed gases. In all these apparatus, chimneys are used to keep in the heat and regulate the flame. By the different methods by mixed gases, the wire gauze is found to be rapidly oxidized, which was to be expected, since at a red heat it is in contact with gases containing, especially on its under side, an excess of oxygen.

In the commencement of my experiments, I used mixed gases, by means of a rectangular box, about $1\frac{1}{2}$ inches wide at the top, of the length of the combustion tube, and divided by a partition at every second

inch; a separate tube and cock controlled the gas in each of these compartments. This method, however, was abandoned after a few trials, as the heat cannot be regulated with the mixed gases to that degree of delicacy which seems desirable; the quantity of gas entering each box must be a fixed one to obtain the best heat, and depends principally upon the air admitted, so that decreasing the amount of gas gives a flame of a very uncertain nature, and very apt to go out. It appeared to me also, that by this method a larger amount of gas is used than is necessary to give the required heat, which excess of heat communicates itself to the apparatus, and is radiated into the room, to the annoyance of the operator.

This appears also true from theoretical grounds; since by dilution with air, the combustible gaseous particles are in the first place further separated from each other and from the tube to be heated, and consequently a larger volume of gases is necessary to get the required heat where the tube is situated. Secondly, the tube is in the most unfavorable part of the flame for heat; this flame forms a hot-air bath, all parts of which have a certain equal degree of heat, excepting the exterior envelope, which is hotter from excess of air; but this part is the most remote from the analysis tube, which receives less heat from this source, while the exterior of the apparatus receives the most. Flame can be applied to a tube in such a manner as to obviate these disadvantages, as a consideration of its nature will show. Undoubtedly, the hottest part of a flame, as of a candle, is the well known slightly luminous envelope, which, besides receiving the radiated heat of the white hot carbon suspended in the inner flame, is hot from the same carbon perfectly burned with access of the outer air; if such a flame could be opened, so as to expose a greater surface to the air, of course a greater amount of heat would be communicated to a body in contact with it; since, with a sufficient amount of air, no carbon would be deposited upon the body. This can be effected with the flame of a candle, though in a much less perfect manner than with a gas flame, from the different conditions of the two bodies. In a candle, the combustible gas is manufactured by the capillary action of the wick and the heat at its extremity, which causes it to act differently from gas ready formed, and forced from an aperture by a constant pressure. If a body be placed above a gas flame issuing from a small hole without smoke, and at such a distance that no carbon is deposited, it is heated by the radiation of the burning gas, and by the current of hot air ascending therefrom; but the heat from radiation is not the greatest possible, since it is inversely proportional to the square of the distance, and would only be greatest if the combustible body were burning on the surface of the body to be heated; in which case, there would be little, if any, loss from convection. If the body be placed still nearer to the flame, carbon is deposited, which lessens the heat.

I soon observed in my experiments, a mode of burning gas issuing from small holes, which I do not remember to have seen noticed elsewhere, but which fulfils the conditions above mentioned, and which I have applied in my laboratory to other purposes besides heating tubes. It is simply to place the body almost in contact with the hole from which the gas issues; by this means the current of gas dashing against the body to be heated, loses its velocity and spreads over it, forming a thin

coating of gas which burns on its surface with excess of air and without smoking. Dr. C. M. Cresson directed my attention to a mode of using gas for heating and cooking, patented by W. Boggett and George P. Pettit, of England, in which they claim the use of burners with minute apertures from an inverted or inclined surface, so that the upward current of air impinges upon the issuing gas. The burner which was shown to me, and intended for heating a stove, consisted of an inverted truncated cone, the apex being downward, and the side pierced with holes, the diameter at top being about four and a half inches, and at bottom about three and a half inches, and the axis four inches in length. The gas burned with a blue flame, heating the earthenware burner to a low red heat. The heat in such a burner appears to act in a manner similar to what I have above described. The gas streaming into the large reservoir and issuing from so many holes, loses its velocity, and covers the burner with a thin atmosphere of gas, exposing a large surface to the air, and burning in contact with the earthenware reservoir, which it raises to a high temperature. I mention it in this connexion, for the purpose merely of alluding to the principle upon which it proceeds, and may add, that it appears to fulfil well the purpose for which it is intended.

My apparatus is double, since two combustions can be effected as readily as one, and requires only the additional time of weighing the necessary parts of the second analysis. I proceed to describe it as it now stands, premising, that it may be made with less expense than described, as it was originally constructed with a view to experimenting upon the various ways of burning the gas. In its simplest form, I think it can be made cheaper than any I have seen; but I prefer it in its present form, as it will fulfil all the ends to which a charcoal furnace may be applied for heating tubes, and will serve for other purposes besides organic analysis. The analysis may be performed according to any of the processes in use; but that which has been principally experimented upon, is that of Hess. The apparatus may be described in two parts; first, as regards the combustion tube; second, as to its other parts.

First. *The combustion tube:—*

According to Hess' process, the front part of the combustion tube, containing oxide of copper, is to be kept at a red heat, as well as the empty part immediately behind the substance which is being analyzed, while the part containing the tray and organic body is to be very gradually heated, at the same time passing with great circumspection a slow current of air or oxygen; at the close of the operation, it is necessary to raise the tray to a low red heat, for the purpose of completely burning the carbon. The great points to be attained are: 1st, a perfect oxidation; and, 2d, that all the products of combustion shall have a forward and never a retrograde motion. To effect this, requires, (and for some bodies to a greater degree than others,) 1st, a careful and slow addition of heat to the organic substance, and which is capable of being readily regulated; and, 2d, a very careful regulation of the oxygen or air-current. If the heat be at a proper degree, while the oxygen or air-current is too strong, the combustible gases will be hurried over the ignited oxide of copper too rapidly to be completely oxidized, (for in the first stadium of the analysis, the oxidation is effected solely by the

oxide of copper,) and the result will be empyreumatic and acid products condensing in the chloride of calcium tube. If, on the other hand, the gas-current be properly regulated, while the heat under the organic substance escapes beyond bounds, the same effect results, and, in addition, the products of combustion go backwards, and empyreumatic substances condense about the cork in the hind part of the tube, from which they cannot be dislodged, and the analysis is inevitably lost. If condensation has not yet taken place on the hind cork, the analysis can nevertheless not be saved by increasing the air or oxygen-current, to drive the products of combustion forward, as they would be thus carried too rapidly for combustion over the oxide of copper. Where oxygen can be used in this stage of the analysis, there is less danger of failure, since the current behind the substance is sufficiently strong to prevent a retrograde movement, while before, (owing to the conversion of the oxygen into carbonic acid,) the current is sufficiently slow to effect perfect oxidation; some substances, however, afford in the first stages of the combustion, gases explosible with oxygen, in which case an air-current must be used to prevent the backward movement, and which, from its large amount of nitrogen, produces a more rapid movement in the part of the tube where the combustion is going on. This case, therefore, requires the greatest care in regulating the heat and gas-current in the commencement. I have found fats to require the greatest care, for the combustion must be made in an air-current; as they yield explosive mixtures with oxygen, they are both fusible and volatile, which requires a very careful regulation of the temperature in the proper portion of the tube. The addition of a long lever to the key of its stop-cock, as proposed by Marchand, renders a delicate adjustment of the oxygen or air-current easy; and I think the apparatus about to be described, will not fail in effecting all that can be desired, in the regulation of the temperatures. Figure 1* (Plate III,) represents a side view of the burner (for one combustion-tube) and stand. The latter is made of walnut, of the dimensions represented in figs. 1 and 2, and at either end having uprights, upon which slide clamps of the kind represented at A, fig. 3. These clamps have the upper part of their two tines filed into a blunt knife edge; and to fit these, notches corresponding to the position necessary to bring the two rows of burners directly under the combustion-tubes, are filed in the bottoms of the brass tubes, from which the gas enters the stop-cocks. By this means, the burner has a firm seat on the two forks, and either end can be raised independently of the other, or it can be taken away altogether, without disturbing the rest of the apparatus. The stand, as represented, is twenty-six inches in length, but it is divided in the middle, and by means of rectangular rods fixed to one part, and sliding in the other, may be drawn out, and a movable piece be inserted, making it six inches longer. The nature of the burner may be seen from figs. 1, 2, and 3; in 1 and 2, it is represented in the air, a little above the forks, upon the edges of which it naturally rests, as seen in the ground-plan, fig. 3; it consists of two long and two short tubes, brazed together to form a rectangular system, along two sides of which, rows of twelve stop-cocks each, are arranged. The gas enters the system at either end,

* Figs. 1, 2, and 3, are drawn to a scale of one-eighth the natural size.

as indicated by the arrows; but I have found that, for most purposes, with the apparatus of the dimensions indicated, one entrance is sufficient. The keys are placed in an inclined position, (fig. 3,) that the hinder ones may be readily turned by a movable key of sufficient length, which is passed between those of the front row. The rectangular system is cut between the first two of either row of cocks, and united with a union joint, and a brace fixed in the portion indicated in fig. 3, to hold the longer portion of the burner firmly, while the connexions are made. Two pieces of three cocks each, and of dimensions corresponding to the rest of the system, may be by means of unions at their extremities inserted at this place, and the burner made six inches longer, to correspond with the lengthened stand. The stop-cocks are soft-soldered into the system, and the burners proper are soldered, or (preferably, as it admits of more easily removing them), screwed into the upper ends of the cocks. These burners are represented in fig. 1. They are each made of two pieces of brass tubing. The vertical piece, (fig. 1,) fitting in the stop-cock, is of the size sold as one-fourth inch, (outside measure,) and is about three inches in length. The upper piece is three-eighths tubing, which is cut in pieces of two inches, the ends of which must be stopped. This is readily effected by cutting a long screw upon a piece of brass wire of the proper size, and with a couple of turns of the corresponding tap, making a thread at either end of the tube; the screw may be then screwed tightly in the ends with white lead, and cut off close. This effects a perfectly tight joint, and so little of the screw is left in the ends of the tubes, that a moderately long one will close a great many holes. The bit of tube thus closed is either screwed with white lead, or brazed into the vertical one, and on its top two rows of holes are drilled, five in each row, the rows being about one-fourth of an inch apart, and the holes of each row $\frac{7}{16}$ths. The flames issuing from these holes will form a continuous row of forks, as seen in fig. 2, in which figure they are placed farther apart than naturally, for the greater plainness of the drawing. The holes are readily bored with a needle drill worked by a bow. After several experiments upon the best form to give this drill, the following was found to be the most effectual, and with it, if the needle be of good temper, a single one will bore nearly all the holes for the burner. A number eight needle is broken off at a convenient length, (a needle will make two drills,) and without taking out the temper, is made square, slightly tapering at one end, which is quickly done on a grindstone or good hone; the end is then squared, and its opposite angles taken off, as in fig. 4, A; the end thus finished, as seen by its drawing, forms an oblong hexagonal figure, the two long sides of which embrace a space equal to about one-third the area of the original square, and bounded at either end by two angles. If the places for the holes are indicated with a centre-punch and a drop of oil added, this drill cuts with extreme rapidity, and does not easily become dull. It is fastened in a watchmaker's hand vise, which turns freely upon an appropriate handle fixed to it, and is worked with a bow. If by careless handling the drill breaks, another can be made and set in operation in a few minutes. I may mention, to show how readily these holes may be made, that in two hours, besides expe-

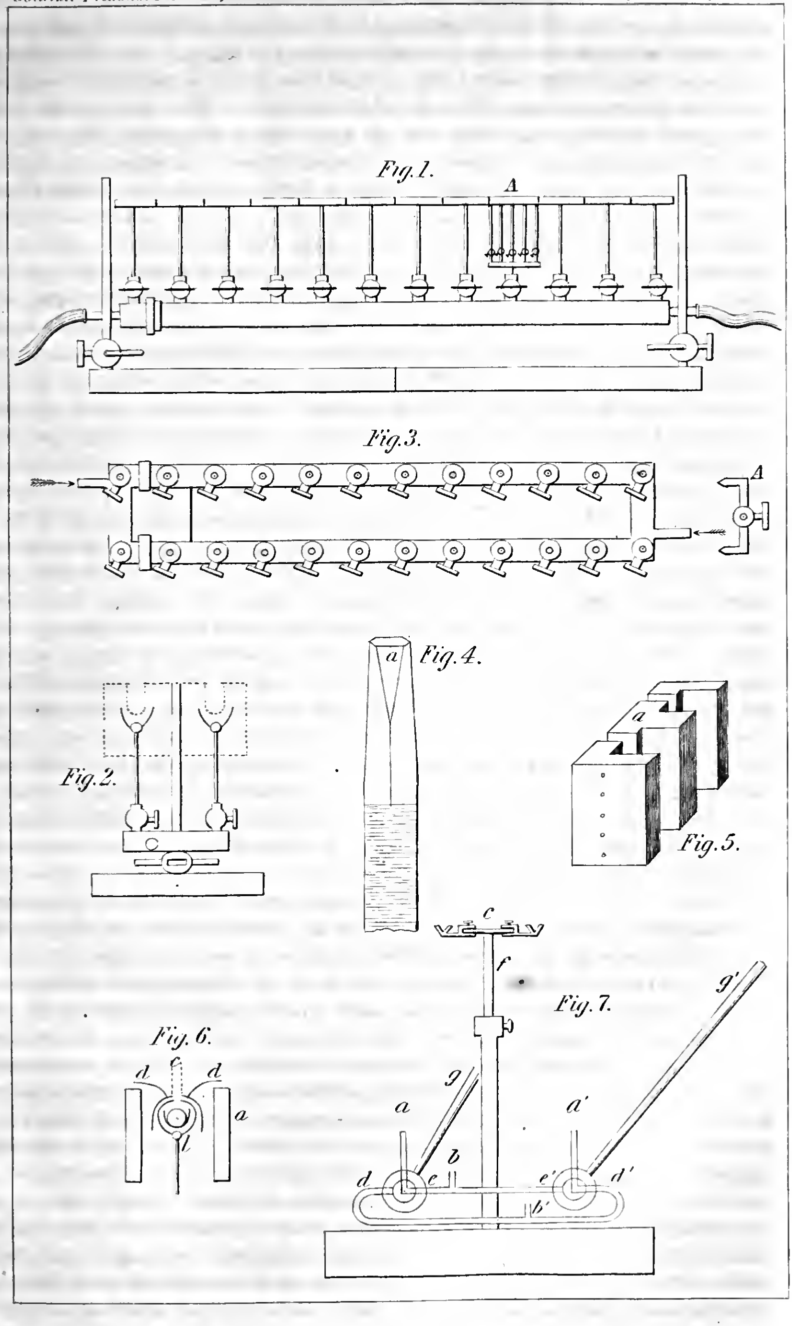


Fig. 1.
A
Fig. 3.
A
Fig. 4.
a
Fig. 5.
a
Fig. 2.
Fig. 6.
d
c
d
a
b
Fig. 7.
c
f
g
g'
a
a'
b
b'
d
d'
e
e'

[illegible]

rimenting at the beginning on the best form of drill, one hundred and sixty-two holes were marked out, punched, and drilled, and for the most part with one drill, which appeared as sharp at the last hole as at the first. Mr. Tilghman, several years since, showed me this mode of drilling fine holes with a needle, in a burner used by him, which will be alluded to in a subsequent part of this article.

Each burner thus finished, gives a double row of flames, ten in all, and which occupy a length of about two inches of the combustion tube; but it is important for the proper regulation of the heat under the organic substance, to have a more extensive control over its advance. This is effected in Hoffman's apparatus by a tube and sliding piston; but it may be more neatly attained, and I think, in the end, as cheaply, in the following manner: The two inch tube from which the flames proceed, is divided into five compartments, which is done by sawing into pieces, cutting screw thread in their ends, and after screwing the long screw in one of these, cutting it off so as to leave a little projecting; another compartment is screwed on to the projecting screw, &c., until they all are united, after which the ends are closed in the same manner; or else the insides of the end of the small pieces into which the tube is cut, are slightly turned away, and little disks are turned off correspondingly and placed between each two, and being clamped together in this fashion, silver solder is melted into the spaces, thus forming five compartments. The tube so divided, is united with another (closed only at the ends), by five smaller tubes, the upper ends of which are brazed into the compartments, and the lower ends connected with the lower tube, each with a small stop-cock. The upper tube has holes drilled into it similarly to the other burners. This compound burner, which represents a gridiron in shape, is placed on one of the large stop-cocks like the other burners, and as represented at A, fig. 1, one such being required for each combustion tube. It is evident that by means of the small cocks, the heat may be advanced in any direction at this part of the apparatus by two flames at a time, and by placing the platinum tray in the combustion tube immediately over the burner, and commencing by lighting the gas at the simple burner on either side, a length of three inches may be controlled by double jets, in the shape of a fork. In special cases, if it be necessary, the two gridiron burners of the apparatus, may be placed side by side, to heat part of a single combustion tube, thus doubling the length so controlled. The small stop-cocks, which would seem to add considerably to the cost of the apparatus, may, nevertheless, be cheaply made of thick brass wire, in the following manner: a drill is made with a conical shoulder of the size required for the plug or key of the stop-cock; this shoulder is ground so as to form cutting edges, and the drill, after hardening, is bored with the shoulder into the end of a suitable rod of steel, the end of which thus bored, is made into the shape of a chisel and hardened. It is plain, that pushing this tool against small bits of wire revolving in a lathe, will rapidly make the plugs of the cocks, which will be of exactly the same size, and will accurately fit the holes bored by the drill into the sides of thick bits of wire, which form the cocks, and which are completed by drilling small holes through the ends of these bits, the plugs being in them. Holes are also bored in the free ends of the

plugs, to enable them to be operated by means of a wire key, bent into an appropriate shape and with a handle. It is not necessary to fasten the plugs, but they should be ground in with flour of emery. These small cocks are $\frac{3}{4}$ of an inch long by $\frac{5}{16}$ diameter at their thickest part, and could be made at an expense of about 12 cents each, and would be found useful in the laboratory for various other purposes than the present. In order to support the combustion tubes and to keep in the heat, a copper jacket is employed, the nature of which will appear from fig. 5, and the dotted lines in fig. 2. It is made of thin sheet copper riveted together, and consists of a middle portion and two ends, one of which is represented in perspective and exaggerated in fig. 5. The middle portion consists of three rectangular pieces, fitting into the three darkly shaded parts of fig. 5, and into the corresponding ones of the other end. All of these parts fit together by insertion like the joints of a stove pipe, and when thus united, the jacket forms a box open at top and bottom, and divided longitudinally by a partition into two portions, forming receptacles for the two combustion tubes. The sides and ends are all double, with air between to confine the heat, and the two notches cut at each end (as in the figures) which receives the combustion tubes, must of course be arranged so that the latter are directly over the rows of flames. At *a*, fig. 5, a tube closed at top is fastened, and inside the cavity of the jacket; there is one at the other extremity, and these slip down upon the uprights of the stand (fig. 1), so as to support the jacket over the burners, as represented in end view in fig. 2. In order to be enabled to lengthen the jacket to suit the rest of the apparatus, when lengthened, there are three additional rectangular middle pieces, by inserting which it may be sufficiently elongated. The jacket has a very stable position, even when at its greatest length, and from the strength given by its form, may be made of very thin metal; the middle partition embraces an inch and an eighth between the two sheets of copper, while the outer walls and ends embrace $\frac{5}{8}$ths. Two semicylindrical trays of sheet iron, occupy appropriate positions in the two compartments of the jacket, and on these the combustion tubes rest upon a layer of calcined magnesia, to prevent adhesion. The burner is brought up to, and almost touching, the bottom of these, and there retained, resting upon the forked clamps A, fig. 3. If the gas be now lighted, it spreads over the bottoms of these iron trays and wraps around the tube, burning with a blue flame. The tubes would be heated more intensely and more completely enveloped by the flame, if the iron tray was not interposed, but experience proved its advantage, for without it the combustion tubes are not only more liable to be so much bent out of shape as to be only available for one or two analyses, but require a much greater care in heating to avoid cracking. Chimneys or jackets are employed to increase the heat and render it more equable, which are made of different lengths, of sheet brass. Two pieces of brass are taken, of equal size and of the requisite length; they are bent as to their length at a right angle, and one of the pieces thus formed is curved semicircularly; at each end of the other plane surface, as well as in the middle of the same, the two pieces are connected by riveting on small slips of sheet brass. It is then bent so as to give the form represented (in section) at *c d d*, fig. 6; *d d* represent additional slips of brass

$\frac{1}{4}$ of an inch wide, which are riveted fast to the four extremities of the chimney and are bent so as to enable it to rest in an appropriate position over the combustion tubes upon the copper jacket. *c* represents one of the riveted slips which hold the two parts of the chimney together. Fig. 6, also represents in section, the arrangement of the different parts of the apparatus in full operation, by which it will be seen how the forked flames from the burner wrap around the tray containing the combustion tube, and are still more reflected upon the tube by the action of the chimney. This appears to act more as a jacket than a chimney, for when made of two semicylindrical pieces, without the portion represented as descending in dotted lines from *c*, the heat appears to be as great. I have also made it with a row of holes for the admission of air in the angles where *d d* join the rest of the chimney; but apparently without any advantage. I have found that a cock with an aperture of $\frac{1}{4}$ of an inch in diameter connecting with one end of the system of burners will furnish more gas than necessary for a double combustion. When the apparatus is lengthened six inches, it is advisable to admit as much gas to the other end, or else have a larger cock for all purposes.

It only remains to consider in this part of the apparatus, the trays in which the organic substance is placed during combustion, and which are made, as usual, of platinum or glass, according to the nature of the substance analyzed. The platinum trays can be readily made by one's self of thin foil, in the following manner, which my friend, Dr. J. Lawrence Smith, suggested to me to try: a bit of steel is turned cylindrically and with hemispherical ends, and of diameter to enter easily the combustion tubes usually employed, and hardened. This is hammered on its side into six different places in a flat piece of lead, each successive cavity being deeper, until the last conceals half the cylinder. The lead mould thus formed is greased, and also the steel, and placing a piece of foil upon the first cavity, the punch is hammered gently upon it until it takes its form; the same is done in the next cavity, and so on to the sixth. After the third cavity, the platinum must be annealed every time. It can then be trimmed off, and forms a very neat tray. To avoid the use of larger combustion tubes when *glass* trays are used, I make the latter of a soda-glass tube, the thinnest that can be obtained. After splitting the tube longitudinally, the ends are drawn off square, and a dish or tray is thus formed, which fits, and is placed in the platinum tray, which prevents the glass from sticking, and is by it protected from the injury of metallic organic salts. Very convenient little platinum dishes for blowpipe purposes may be made as above, using the end instead of the side of the steel punch.

(To be Continued.)

Translated for the Journal of the Franklin Institute.

Specific Heat of Gases. Regnault.

M. Regnault read to the Academy of Sciences, (Paris,) a very long Memoir on the Specific Heat of Gases under constant pressure and variable volume, and under constant volume and variable pressure. After

detailing the history of this important question, Mons. R. explained in a brilliant lecture his method of observation, the arrangement of his apparatus, and the important results which he had obtained, results which entirely change the present state of the science, being in complete discordance with the theory of Laplace, and Poisson, and with the observations of MM. Clément Désormes, Gay-Lussac, Welter, and Dulong.

It has been heretofore admitted, that the capacity for heat under constant pressure, is always greater than that under constant volume; and the ratio of these capacities is equal to unity plus a fraction, which in air, is 338 thousandths according to Dulong, 375 according to Gay-Lussac, 421 according to Poisson, &c. By operating in an entirely new mode, and under conditions that he thinks better, M. Regnault seems to have shown, that the difference between these capacities is nothing, or, infinitely small. We shall republish almost entire, M. Regnault's Memoir, and shall cite here, only a few of his experiments and the conclusions which he has deduced.

Conceive two concentric globular vessels, one, whose capacity is a litre filled with gas, (air, for example,) under a pressure of ten atmospheres, the other with a capacity of ten litres. This system of two vessels is immersed in a water bath kept at a constant temperature. If, after having made a vacuum in the second globe, we allow the air to enter it from the first, so that it now occupies a bulk ten times greater, there is neither elevation nor depression of temperature. There will be, however, a depression of the temperature, if at the same time that the air enters the larger globe, a small quantity of the air is allowed to pass out by an orifice in the globe; and the amount of depression of the temperature is constantly proportional to the mass of gas which has escaped into the atmosphere. If the air which escapes is made to do work, as for instance, to move a turbine, re-action wheel, or pump, the cooling increases in proportion to the work done; and we, in consequence, find here, what has been determined in steam engines, in which the useful work done, is more nearly expressed by the heat lost in the fall of temperature, in proportion as the machines are more perfect.

M. Regnault shows clearly, how much his new experiments are opposed to the old hypothesis, which made *caloric* a fluid, at one time in a latent state, at another, disengaged and sensible; he shows, on the other hand, how easily they are explained on the theory which attributes heat to a vibratory motion: the principle of the preservation of moving forces, then, suffices to account for all the transformations of heat into work, and vice versa. After again insisting upon the fact that the theory by which Laplace corrected Newton's formula for the velocity of the propagation of sound in air, and explained the considerable differences between the calculated and observed velocities, is no longer admissible, he expresses an ardent desire to see some new series of experiments on the velocity of sound in air, water, and solid bodies, taking advantage of all the recent progress of science and the mechanic arts.

Cosmos, vol. iv, p. 597.

For the Journal of the Franklin Institute.

On an Improvement in the Manufacture of Iron and Steel. By M. August Laugel: Paris.

Scientific revolutions are always caused by the discovery of some entirely new principle, industrial ones, by a new and happy application of principles long known, but from which all the results have not yet been obtained.

I propose in this brief memoir to demonstrate the possibility of an industrial revolution in the United States with regard to the manufacture of cast-iron, iron, and steel.

A few historical considerations must first be presented. It is universally known, that iron was at first manufactured exclusively by means of charcoal with apparatus of small dimensions. This method precluded the preparation of large quantities, and it became quite insufficient when the introduction of steam-engines gave to industry so much wider a field. The immense importance of coal began to be recognised, and iron was manufactured by its means, according to new methods, which favored its more rapid production in greater quantities.

A rivalry thus commenced between the coal foundries and those kept up by wood, in which the latter were evidently to be overcome. The nations possessing great coal districts, particularly Great Britain, became the producers of iron for all the rest.

In these circumstances, if suddenly there should be discovered a new means of making iron with wood as rapidly and as economically as it is done at present with coal; if besides, the iron thus prepared should offer in quality very great advantages in comparison with that made with coal, is it not natural to suppose, that the consumers who are only attracted by the cheapness of English iron would cease to employ it? Even admitting that under certain circumstances this iron would be dearer, they could more advantageously use it for those purposes for which iron of the first quality is indispensable, such as the manufacture of steel.

The country best situated for the success of this industrial revolution, is, undoubtedly, the United States of America. For example, wood is found there in great quantities, and may, in some places, be obtained at a very low price; on the other hand, the beds of mineral-iron are very numerous: modes of transport, always important in the working of iron, exists in great numbers; here we find all the conditions necessary to success. It remains only to establish with certainty the advantage of this new method of manufacturing iron, and to explain its high importance.

1st. Wood is not charged with those mineral substances, which injure at once the calorific effect, and the quality of the metals fabricated by it. Coal contains often 10 per cent. of matters either useless or injurious. Wood, on the contrary, contains hardly ½ per cent. of mineral substances, which, besides, are never injurious. All wood has great chemical uniformity, while coals differ much from each other, which involves the disagreeable necessity of ranging the methods of employing them. It is well known to metallurgists, that wood should not be employed as a

combustible, without previous preparation, on account of the large proportion of water which it contains.

For many years, the most various experiments have been made to prepare the wood before using it as a combustible. The method to which we would now call attention, has been used for a very short time in Styria and Carinthia, which consists in taking from the wood only the water, and stopping the distillation as soon as the substances which escape begin to contain carbon. Two methods have been used to effect this conversion of wood into *ligneux* (lignum).

1st. The gases coming from the fire-place are brought into immediate contact with the wood; thus the wood is raised to a temperature above 100° Centigrade, which favors still more the vaporization by the tendency the gases themselves have to be saturated with vapor.*

In the second method, only the heat radiating from the gases in the fire-place is employed. These gases are not brought into immediate contact with the wood, but are conducted in pipes of cast or sheet-iron around which the wood is piled.

This second method affords by far the most satisfactory results; being the more economical, and avoiding the disadvantage which sometimes attends the first, of making the *ligneux* pyrophoric, and thereby liable to spontaneous combustion on exposure to the air.

It is important to render the second method still more perfect: the following means might be advantageously employed; the combustion of the wood employed effects the conversion into *ligneux* which is thus raised to a temperature of 150° Centigrade: All the water contained in this wood escapes in vapor, but the heat contained in this vapor and in the *ligneux* should be made useful as well as the latent heat contained in the vapor. For this, three successive chambers will be necessary; the wood loaded on wagons passes in succession from one chamber to another; in the first chamber the wood will begin to be heated and to dry by means of the latent heat of the vapor, disengaged in the second, and condensed in the third, and also by means of the latent heat of the air cooled in the third and brought back to the first. It is in the second chamber that the entire conversion of the wood into *ligneux* takes place: the *ligneux* will pass into the third chamber to cool; the heated air will be conducted to the first chamber to heat another load of wood; the vapor which is found there, and which comes overheated from the second chamber, will be condensed, and thus will give more heat to the first chamber, with which it communicates by pipes.

In following the preceding method, it is possible to change 10 parts of wood (standing for 1·00 of *ligneux*, 0·40 of water) into *ligneux*, by means of one part of wood employed as a combustible.

There is another method more economical which might be employed to convert the wood into *ligneux;* it consists in utilizing the wasted flame of the metallurgic apparatus after having, of course, previously used it for other purposes; for example, heating the cauldrons, because, on coming from the apparatus the gas is of too high a temperature for the operation in question, and is still sufficiently hot after having been em-

* It is unnecessary in this memoir to describe either the chamber in which this process takes place, or the requisite apparatus and details of the different processes.

ployed for the previous processes. But this method by which economy is carried to the utmost extent, though very suitable in France or Germany, does not seem necessary in America, on account of the cheapness of the vegetable combustible. Thus far we have only explained, and very briefly, the first part of the new method of manufacturing iron. We now come to the second part, which is the *puddling process* with *ligneux;* the puddling, it is well known, is effected by burning in a reverberatory furnace the combustable gases which come from a lateral fire-place: the important part of the operation is, to conduct into the furnace a sufficient quantity of air, to produce a total combustion of the gaseous substances. Generally, too much air is admitted, which has the disadvantage of uselessly absorbing the heat. Mineral combustibles are much better adapted than wood to the operations of the puddling furnace on account of their superior density; they develop a greater quantity of heat and also produce a more regular current of gas; besides which, the interstices between the pieces of wood permit too much air to pass. In the new puddling process, the quantity of air introduced into the furnace is, so to speak, mathematically regulated: the combustible mixture and the current of air which serves to ignite it, are admitted separately into the laboratory: here, the fire-place must be of entirely different dimensions. It is very long vertically, the grate is very low, and composed only of a few bars to support the wood: the air no longer enters freely into the fire-place; the bellows send a graduated current of air under the wood, which traverses it, producing its distillation. On account of the pile which the air is obliged to traverse, this distillation takes place, so to speak, in a gradual and progressive manner: the air thus admitted into the lower part, is in proportion to the quantity of *ligneux* required to be carbonized in a given time. The current of combustible gas which is found in the pile of wood passes into the laboratory, where the puddling takes place, and is met by a current of air carefully regulated and driven through a pipe; thus the laboratory obtains, instead of an ordinary flame, a combustible gas free from all traces of pure oxygen. Nothing is more easy when one understands the composition of *ligneux*, than to know the exact quantity of air to admit into the furnace. But in what proportion shall the whole amount of this quantity be divided? How much shall go to the furnace and how much to the laboratory? This is a question which experience alone can answer. We can only say in general, that the latter proportion depends upon the more or less combustibility of the mixture of gases, and consequently on the temperature required in the furnace, the rapidity of the distillation, and the operation itself.

This last term has evidently in all cases a limit, which fixes the proportion to be established between these two currents of air. Registers also connect them with each other, which can be managed by the workmen themselves. This mode of combustion is very remarkable, both theoretically and practically; it produces a very great regularity in the labor, and gives a current of very pure gas: the purification of the cast-iron is thus effected under the most favorable circumstances, and even very impure kinds give excellent iron. It is quite otherwise, it is well known, with the ordinary method of puddling with coal, and we may assert in general, that the impurity of iron is attributable less to the cast-

iron than to the imperfection of the mode of reviving. In the United States the cast-iron made with wood or anthracite, would never be of a very bad quality;* the admirable perfection of the puddling with *ligneux* would warrant the excellence of the products of the new method. It now remains, and this is the main point, to consider the economical conditions of the question.

The following are the facts of the case, the exactitude of which we will warrant.

The consumption of cast-iron, labor, and *ligneux*, are per ton of iron:

Cast-iron,		tons	1·242	
Labor	For the puddling,	days	3·86	11·35.
	For forging and rolling,	"	4·69	
	Sundry processes,	"	2·80	
Ligneux	For the puddling,	tons	1·20	2·50
	For forging and rolling,		1·30	

This estimate may serve to establish the *special* expenses in each particular case: in order to establish the *general* expenses, it will be necessary to obtain information on the following points:

1st. The purchase of land.

2d. The price of building, materials, stones, bricks, clay, etc., etc.

It will be important, in order to diminish as much as possible the total amount, to choose a situation where wood is cheap and abundant and in the neighborhood of the mines, from whence the ore could be brought at a small expense. (In case it should be preferable *not* to manufacture the cast-iron, this last observation applies to the cast-iron which it would be necessary to buy.) It is also important to take into account the means of transport of the produce, to the great industrial markets, by canal or railroad; the price of labor, etc., etc.

It would be well perhaps to annex to the establishment, a manufactory of cast-steel; the *ligneux* would be very suitable for this species of manufacture; and it would be very easy to prepare for this purpose, iron of the best quality. The establishment of the works required by this new method, must be on a very large scale; its success depends almost entirely on the employment of the most economical means of manufacturing *ligneux;* this condition can only be fulfilled by preparing the ligneux in great quantities, and consequently the metallurgic apparatus must be very numerous.

The solution of this problem, which we have been examining, is in the highest degree important to the future progress of industry in the United States. It will enable them to employ to advantage, the mineral wealth scattered over their territory, and upon a point of the utmost consequence, will render them independent of other nations. It therefore eminently deserves the attention of the metallurgist and the manufacturer.

* It remains to be seen, perhaps, if it would not be advantageous to manufacture the cast-iron also with ligneux.

For the Journal of the Franklin Institute.

Description of an Apparatus for Broiling by Gas Heat.

The apparatus shown at the June meeting* of the Institute for this purpose, has proved so effectual after having been in daily use by myself for several weeks, that I am desirous of saying a few words descriptive of it in the *Journal.*

It is simply a system of tubes brazed together in the form exactly of a gridiron; the tubes represent the bars, having small holes drilled with a needle through them, half an inch apart. The gas entering these by a tube in the position of the handle of the gridiron burns in a number of jets. This burner should be made to be used with and on the pattern of the ordinary guttered gridiron, so that a row of flames comes under each bar; in this way, when the burner and gridiron are kept parallel to each other, and inclined by a support soldered to a shallow tin pan, there is no danger of the fat falling into and stopping up the holes of the burner. In any event, there is little annoyance from this source, as proved by my own apparatus, which was constructed by myself, and without any particular care. The burner should be brought as closely to the gridiron supporting the object to be broiled, as is possible, without the gas smoking, and the object is cooked in a few minutes. The burner may be made of brass tubing, as nothing but fat falls, (which is caught in the tin pan,) all the gravy being retained in the meat, and which flows out when the latter is cut.

I do not know whether this method has been used before, though I suppose it has been; at any rate, it is a method I can recommend from experience, having used it for mutton-chops, beef-steaks, spring chickens, and oysters. By placing the burner horizontally, a vessel placed on the gridiron will be sufficiently heated for boiling or frying, or it may be used for toasting bread. The cost of the whole apparatus is very trifling.

C. M. W.

For the Journal of the Franklin Institute.

The Transatlantic Steamship Herman. By B. F. Isherwood, Chief Eng. U. S. Navy.

(Continued from p. 57.)

Conditions under which the evaporation by the boilers is calculated.

During the entire steaming with both sets of boilers, the temperature of the feed water was carried very regularly at 120° Fahr., and a sufficient amount of "*blowing-off*" was done to maintain the sea water in the boilers at one and three-quarters the natural concentration. The initial steam pressure in the cylinders was three pounds per square inch less than in the boilers, and the steam space between the pistons and cut-off valves at *one* end of *both* cylinders was 22 cubic feet.

With the first boilers, the natural draft, though good, was insufficient to consume on the small area of the grates, the large amount of coal required to generate a sufficient supply of steam. To effect this purpose, an artificial blast was used, obtained from centrifugal fans driven by small

*Not the apparatus mentioned in the Report of the Meeting, mine having been omitted.

independent steam cylinders. These centrifugal fans were constantly required to be driven at a high velocity, and the amount of steam required to work the small blowing engines was, from as close a calculation as can be made without Indicator Diagrams, five per centum of the amount of steam used in the large engines. This five per centum is included in the calculations of the evaporation.

With the last boilers, only the natural draft was used.

The calculations for the Evaporation by the Boilers, contained in the following Table, are made for the above conditions, using Regnault's Determination of the latent heat of steams; and they include the loss by "*blowing-off*" to maintain the above concentration of the sea water in the boilers; they also include the steam comprised between the pistons and cut-off valves, and the steam used to drive the fan blast with the first boilers.

Evaporation by the Boilers.

	First Boilers.		Last Boilers.	
	Burning Pennsylvania anthracite.	Burning Welsh anthracite.	Burning Cumberland bituminous.	Burning Welsh anthracite.
DATA.				
Steam press. in lbs. pr sq. in. above atmosphere in boilers.	11·9	11·1	11·6	13·5
" " " " in cylinders.	8·9	8·1	8·6	10·5
Steam cut-off at in cylinders, in feet from commencement of stroke of pistons,	5·000	5·334	3·517	3·908
Number of double strokes of pistons made per minute,	10·086	9·219	10·250	10·326
Pounds of coal consumed per hour,	3791	3474	3376	3470
Total time of steaming, in hours and minutes,	780 50	904 50	1573 37	1639 53
Total number of tons of coal consumed,	1322·571	1403·442	2372·083	2540·525
RESULTS.				
Pounds of steam evaporated per hour by one pound of coal,	6·785	6·894	5·236	6·095
Pounds of steam evaporated per hour from one square foot of heating surface,	4·332	4·030	2·115	2·532
Cubic feet of steam of atmospheric pressure furnished per minute,	11670·954	10858·155	8612·440	9587·320
Pounds of coal consumed pr hour pr sq.foot of heating surface.	0·638	0·585	0·404	0·416
" " " of grate surface.	20·732	18·984	12·079	12·415

Particular attention is called to the results given in the above Table; they establish,

1st. That of the two sets of boilers; the first boilers were of superior type in *economical* evaporation, giving, with the Welsh anthracite, 13·19 per centum higher result than the last boilers, although, with the first boilers, the coal was burned with a powerful artificial blast, at the rate of 18·984 pounds per hour per square foot of grate surface, and a proportion of 32·48 square feet of heating surface per square foot of grate surface to absorb the large amount of caloric evolved; while with the

natural draft of the last boilers, there was only burned per hour 12·415 pounds of coal per square foot of grates, with a proportion of heat absorbing to grate surface of 29·88 to 1·000. It will be perceived that the rate of evaporation in the first boilers per square foot of heating surface, was about twice that of the last boilers. Had the consumption of coal per square foot of grate surface, or in other words, had the velocity of the draft been the same in both sets of boilers, the first set must have given a still higher comparative *economical* result. As regards the *potential* result, the first boilers were, likewise, superior to the last, furnishing 11·69 per centum greater bulk of steam in equal times, using the Welsh anthracite.

2d. That the Pennsylvania and Welsh anthracites, gave very nearly the same economical effect, the latter exceeding the former 1·61 per centum: this is about the same result as given by the burning of the same coals in the boilers of the steamships "*Pacific*" and "*Arctic*" of the Collins' line, related in previous numbers of this *Journal*, and arises from their almost identical chemical composition, the chief difference consisting in the Pennsylvania anthracite, having a few per cent. most slate, and making in the furnace more clinker.

3d. That the Welsh anthracite, (with last boilers,) gave a superior economical evaporation over the Cumberland bituminous coal, of 16·41 per centum, and consequently, the Pennsylvania anthracite, a similar superiority of 14·58 per centum. This is also about the same result as given by the burning of these coals in the boilers of the above named steamships, though, showing less superiority than in these cases, because the boilers of the "*Pacific*" and "*Arctic*" giving a higher economical evaporation than the boilers of the "*Herman*," absorb more of the total heat evolved, and show in a more marked manner, the relative steam generating powers of the coals.

The reader will not fail to remark, that the foregoing conclusions are not derived from a few short experiments on a few tons of coal; but are based on a course of many days continuous steaming, and the consumption of many hundred tons of coal. This coal was burned under the ordinary conditions of actual practice, by experienced engineers and firemen, wholly disinterested, and only desirous of obtaining the highest result from all, in order to make the best possible speed, and, as speed of vessel was the first object to be attained, the boilers and fuels were so managed, as to obtain from them their utmost maximum performance. Their conclusions are therefore entitled to a confidence which is not given by practical men, and wisely so, to the laboratory experiments of philosophers.

Relative Efficiency of the first and last paddle wheels.

The difference between the two paddle wheels was what resulted from reducing the width of the paddle from 36 to 26 inches, or a reduction of 28 per centum; and in making the paddle in one piece instead of two pieces, bolted on opposite sides of the arms. Similar alterations have been made in the paddles of nearly all the New York steamers, and will illustrate the force of fashion even in such things; for, although the change has become general, yet so far from being based on the results of

accurate experiments, it appears to be in opposition to them, and in opposition also to the nature of things. A few years ago the split paddle, as it is termed, (the same as the "*Herman's*" first paddles,) was equally fashionable, and all steamers were fitted with it; it had the slight disadvantage of offering the direct resistance of another paddle edge to immersion and emersion, and the considerable advantage of relieving the paddle more quickly of the water it carried up on emerging: also, one-half the paddle being in advance of the other some four or five inches, (the width of the arm,) there was produced less concussion on the water than with the single piece paddle. The mere substitution, however, of the single for the split paddle, would hardly have produced a perceptible difference, so long as the same total width was preserved; but when the fashion extended to converting broad into narrow paddles, the result, as might have been anticipated, was an increase of the slip, and to the amount of that increased slip, a consequently increased loss of useful effect from the power.

In the different voyages of the "*Herman*," the effect of the alteration of the paddles on the slip cannot be seen from the calculated slips alone, on account of the different resistance offered by the same vessel to the paddles when experiencing different weather. In estimating the effect, then, of the decrease in the paddle surface, the weather must be included as a governing element, and the best method of ascertaining the different resistances of the vessel, caused by differences of weather in the various cases, will be to eliminate from the total power developed by the engines, the power actually applied to the propulsion of the vessel.

For this purpose, the pressure required to work the engine, *per se*, will be taken at one pound per square inch of piston, for a speed of ten double strokes of piston per minute, and for any variation from this speed to be increased or decreased in the direct proportion of the speed. The power required to overcome the friction of the load, will be taken at Morin's coefficient of $7\frac{1}{2}$ per centum of the total power developed. These friction resistances must *first* be taken from the total or gross power developed by the engines, as it is evident they must *first* be overcome before the engine can move at all or develop power; and the remainder only of the total power is what is applied to the paddle wheel. Of this remainder a certain portion is uselessly expended in what is called the oblique action of the paddles, resulting from the facts that the power of the engine is applied at *right angles* to the paddles, but is transmitted by the paddles to the water *obliquely* to the vessel's motion; there is consequently at the water, a decomposition into two resultants of the power applied to the paddles, the one resultant being horizontal in the direction of the vessel's motion, and the other vertical at right angles to the vessel's motion; the latter is, of course, uselessly expended, and the proportion of this vertical resultant to the whole power considered as unity applied to the paddles, is what is termed the oblique action, which is calculated in the following case in the ratio of the squares of the sines of the angles of incidence of the paddles on the water, for every ten degrees variation in immersed position, and the mean taken. The power composing the horizontal resultant produces two effects, the one a forward motion of the vessel, the other a backward motion of the column

of water pressed by and yielding by its mobility to the pressure of the paddles; this latter is termed slip, and as the pressure by the paddles producing the advance of the vessel and the recession of the water is the same, it is evident that the relative power expended in the propulsion of the vessel and on the slip, will be in the proportion of the speed of the vessel to the speed of the slip; the power in the horizontal resultant being divided in this proportion, gives, separately, the power expended in propelling the vessel and on the slip.

There are other small losses of useful effect by the paddle wheel, but they are so small, even in their aggregate, that it is unnecessary to include them in a general calculation; they are the friction of the paddles on the water, the direct resistances of the lower and upper paddle edges to immersion and emersion, and the displacement of water equal to the bulk of the paddles.

Omitting these, the data of the following Table of calculations are positive, with the exception of the pressure required to work the engines alone, which pressure is estimated, as above stated, from experiments on other similar engines, and can be but little from the truth:

Disposition of the Total Power Developed by the Engines of the Herman.

	FIRST PADDLE WHEEL.		LAST PADDLE WHEEL.	
	New York to Bremen.	Bremen to New York.	New York to Bremen.	Bremen to New York.
Mean gross effective pressure in lbs. pr sq. in. of piston.	16·00	15·90	13·00	15·30
Pressure in pounds per square inch of pistons—				
Required to work the engines *per se*, . .	0·98	0·92	1·02	1·03
Required to overcome the friction of the load,	1·20	1·19	0·98	1·15
Applied to the paddle wheel, ...	13·82	13·79	11·00	13·12
Expended in the oblique action of the paddles,	2·79	2·78	2·22	2·65
Applied in the direction of the vessel's motion,	11·03	11·01	8·78	10·47
Expended in the slip of the paddles, . .	1·39	2·14	1·24	2·04
" " " propulsion of the vessel, .	9·64	8·87	7·54	8·43
Number of double strokes of engine's pistons made per minute, ...	10·086	9·219	10·250	10·326
Horses power expended in the propulsion of the vessel,	478	404	381	430

For the purpose of ascertaining the relative resistances of the vessel in the four cases presented, it will be necessary to modify the "horses power expended in the propulsion of the vessel," as given in the above Table, so as to make them correspond to an uniform speed of vessel, for which nine geographical miles per hour will be selected. This modification will be made in the ratio of the cubes of the actual speeds, compared to the cube of the speed, nine miles per hour. Then, as the normal resistance of the vessel was, of course, always the same, the difference in the horses powers thus obtained will represent the differences in the resistances of the vessel caused by difference of weather.

Making the necessary calculations, we obtain the results contained in the following Table, viz:—

	Actual speed of vessel in geographical miles per hour.	Horses power expended in the propulsion of the vessel at the actual speed.	Horses power required for the propulsion of the simple vessel at the speed of nine geographical miles per hour.	Relative resistance of the vessel caused by difference of the weather.
First Paddle Wheel.				
From New York to Bremen,	9·236	478	442	1·2774
From Bremen to New York,	7·778	404	626	1·8012
Second Paddle Wheel.				
From New York to Bremen,	9·290	381	346	1·0000
From Bremen to New York,	8·840	430	454	1·3121

Now, the slip of a propelling surface in water is caused simply by the difference in the resistance of the body propelled and of the water acted on or pressed by the propelling surface; consequently, the slips of the same propelling surface should be a true measure of the resistances of the bodies propelled, supposing that any difference in the slips do not alter the conditions under which the propelling surface acts. With paddle wheels, the propelling surfaces are simple rectangular planes, situated so far apart that a considerable variation in slip does not very materially affect their propulsive power, though it does, in a degree, sufficient to be sensible, inasmuch as the efficiency of the paddle decreases with the increase of slip, on account of the consequently greater velocity caused by the slip of the water acted on by the paddles in the direction of the paddles' motion; whence, results that with increased resistance, the slip of the paddle ought to increase in a ratio somewhat higher than direct; as, however, this variation from a direct ratio is not great, for the cases occurring in ordinary practice, it will lead to no great practical error to neglect it in making the following comparison between the resistances of the vessel, as determined in the immediately preceding table, and from the slips of the paddles, as follows, comparing the *same* paddle wheel in its two cases.

In the first case, with the first paddle wheel, we find the mean slip for the voyages from New York to Bremen to be 12·60 per centum; and for the voyages from Bremen to New York to be 19·48 per centum, or the slip in the latter is $\left(\frac{(19\cdot48-12\cdot60)\times100}{19\cdot48}=\right)$ 35·32 per centum greater than in the former. Now the relative resistances of the vessel in these

voyages, was, from the preceding table, 1·2774 and 1·8012, or in the latter it was $\left(\frac{(1·8012—1·2774)\times 100}{1·8012}=\right)$ 29·08 per centum greater than in the former.

In the second case, with the second paddle-wheel, we find the mean slip for the voyages from New York to Bremen to be 14·78 per centum; and for the voyages from Bremen to New York to be 19·50 per centum, or the slip in the latter is $\left(\frac{(19·50—14·78)\times 100}{19·50}=\right)$ 24·21 per centum greater than in the former. Now the relative resistances of the vessel in these voyages, was, from the preceding table, 1·0000 and 1.3121, or in the latter it was $\left(\frac{(1·3121—1·0000)\times 100}{1·3121}=\right)$ 23·79 per centum greater than in the former.

From the two immediately preceding paragraphs, it appears that, practically, within the ordinary limits of practice, the slip of the paddle wheel may be taken to increase in the same ratio with the resistance thrown upon it. On this assumption, it is easy to compare the slips of the first and second paddle wheels with equality of resistance, as follows, viz. The resistance of the vessel in the voyages from New York to Bremen with the second paddle wheel was 1·0000, and with the first paddle wheel 1·2774, or 27·74 per centum of the former greater. Now, in these cases the slip with the first paddle wheel was 12·60 per centum, and with the second paddle wheel 14·78 per centum; if, therefore, the 14·78 be increased 27·74 per centum, it will become 18·88 per centum, which ought to have been the slip of the first paddle wheel if it had had only the same propulsion power as the second; but we find that the slip of the first paddle wheel was actually 12·60 per centum, or $\left(\frac{(18·88—12·60)\times 100}{18·28}=\right)$ 33·26 per centum less than the slip of the second paddle wheel. Again, the resistance of the vessel in the voyages from Bremen to New York with the second paddle wheel was 1.3121, and with the first paddle wheel 1·8012, or 37·28 per centum of the former greater. Now, in these cases, the slip with the first paddle wheel was 19·48 per centum, and with the second paddle wheel, 19·50 per centum; if, therefore, the 19·50 be increased 37·28 per centum, it will become 26·76 per centum, which ought to have been the slip of the first paddle wheel, if it had had only the same propulsive power as the second; but we find that the slip of the first paddle wheel was actually 19·48 per centum, or $\left(\frac{(26·76—19·48)\times 100}{26·76}=\right)$ 27·20 per centum less than the slip of the second paddle wheel. Proceeding in the same manner, and making the comparison between the first paddle wheel in the voyages from New York to Bremen, and the second paddle wheel in the voyages from Bremen to New York, we obtain for the first paddle wheel 33·68 per centum less slip than the second paddle wheel. And

again, comparing the slips of the first paddle wheel in the voyages from Bremen to New York, and the second paddle wheel in the voyages from New York to Bremen, we obtain for the first paddle wheel 26·77 per centum less slip than the second paddle wheel. The mean of the above four determinations is $\left(\frac{33 \cdot 26+27 \cdot 20+33 \cdot 68+26 \cdot 77}{4}=\right)$ 30·23; that is to say, the propulsive power of the first paddle wheel, was 30·23 per centum greater than the propulsive power of the second paddle wheel, taking the latter as unity. Now, the propelling surfaces of the two paddle wheels compared as their widths of paddles, viz., 36 and 26 inches, or the surface of the first paddle wheel was $\left(\frac{36-26 \times 100}{26}=\right)$ 38·46 per centum greater than the surface of the second paddle wheel, taking the latter as unity. The conclusion, therefore, is, *that increasing the width of a paddle from* 26 *to* 36 *inches, or* 38·46 *per centum, decreases the slip* 30·23 *per centum, that is to say, if the absolute slip in the first case was* 20·00 *per centum, it will in the second case be* 13·95 *per centum*, which is also about the conclusion to which a plain common sense view of the matter would lead.

For the Journal of the Franklin Institute.

Trial Trip of the United States Screw Steamer, "San Jacinto," with new machinery.

An account of this ship and the trial trip made in New York Bay, in October, 1851, was published in this *Journal*, Vol. xxii. p. 339, 3d Series. Subsequently to the trial referred to, the ship was sent round to Norfolk, broke down on the trip, and after being repaired, was ordered to the Mediterranean. Thence she returned, after eighteen months' absence, a great portion of which time was occupied in repairing, with her engines crippled. An examination was then held by a Board of Engineers appointed for the purpose, and the engines and propeller were condemned and sold. The boilers, which were of copper, were found to be in good condition, and were left on board. The original engines were defective in plan and proportion, and the propeller had too much pitch, and gave too large a per centage of slip. Owing to the repeated failures and enormous cost of our naval steamers, which had previously to this time been built from plans furnished by the Department, by contractors who, of course, assumed no responsibility, it was decided by the Secretary of the Navy to contract for the new engines and propeller for the *San Jacinto*, on the system pursued in the mercantile marine, viz: paying a lump price for the whole, completed in accordance with general plans prepared by the contractors and approved by the Department, the detail and proportions being left to the former, they assuming the whole responsibility of the successful operation of the engines, and guaranteeing for a certain period of time against any defects of material or workmanship. Proposals on this basis were accordingly issued, and the plan and tender of Merrick & Sons, of Philadelphia, for a pair of geared

engines and three bladed screw, was accepted in September, 1853. The machinery constructed by these gentlemen having been completed, was tried at sea, from June 30th, to July 7th, and having performed satisfactorily, has been accepted by Government.

The present machinery of the *San Jacinto*, consists of two horizontal cylinders placed athwartships, and on the same side of the ship, the pistons connecting to cranks at right angles on a shaft carrying four mortise spur wheels, placed side by side and gearing back into iron pinions on the propeller shaft, which passes under the guides of the piston rods. The air-pumps are worked by overhead beams connected to the main crank-pins. The cylinder piston-rods pass through the back heads and play in close copper casings. The general form of the engines is similar to that of H. B. M. S. "*Dauntless*." Between the cylinders is a tubular condenser, constructed on "Pirsson's Equilibrium Fresh Water" patent. The steam and exhaust valves are equilibrium poppet valves, and steam is cut off by Allen & Wells' adjustable arrangement. The engines are on deep cast iron bed-plates, and are connected together at the cylinder end by the condenser. The force and bilge pumps and fresh water air pump, are placed between the forward engine and the fire room, and are worked from an independent shaft gearing into the propeller shaft. Each boiler has a separate connexion to its own force pump, so that either salt or fresh water may be fed into either. The fresh water air pump is used to withdraw the fresh water or condensed steam, and the uncondensed vapor, from the condenser, and pump it into a reservoir, from which it is taken by the force pumps.

The boilers are the same (three in number) as were previously in the ship.

The propeller is a true screw of brass, three bladed; a clutch coupling permits its disengagement from the engines when the ship is under sail.

The following are some of the principal dimensions and proportions of the machinery:

Engines—

Diameter of cylinders,		5	feet	10	inches.
Stroke,		4	"		
Diameter of air pumps,		3	"	2	"
Stroke,		2	"		
Breadth of ship occupied by engines,		24	"		
Length " " "		23	"		
Diameter of spur wheels, (wooden cogs,)		10	"	1½	"
" pinions,		4	"	5¾	"
Face of each pinion,				10	"
" all		3	"	4	"
Pitch,				4	
Proportion of gearing	1 to 2¼ inches.				
Maximum revolutions of engine,	25.				
" " propeller,	56¼.				
Tubular surface in condenser,		1550 sq. feet,			

being disposed in 1240 copper tubes, 1 inch diameter, 5 feet long.

Propeller—True screw.

Diameter,		15	feet.		
Pitch,		22	"	6	inches.
Length,		3	"		
Blades,	3	3			

Prōportion of pitch, 4-10ths.

The performance on the trial will be seen from the following abstract; it should be borne in mind that the vacuum given is the vacuum *in the cylinders*, the attachments being made in the steam chest directly above the nozzles; it therefore is apparently lower than usual. From some causes, probably incident to new machinery, the vacuum steadily improved during the trial, and has since been still further improved by a slight alteration to the condenser.

The condenser performed well, furnishing more than enough fresh water for two out of the three boilers.

The coal on board, was a lot of anthracite, taken from the Philadelphia Navy Yard, which had lain there exposed to the weather for some months. It was pronounced, by the Board of Engineers, to be of a very inferior description, and gave much trouble during the whole trip. From this cause the head of steam was at no time so high as it should have been, although, from past experience with the boilers, it is known that they are of ample capacity.

Conditions of the Ship on the Trial.

Draft of water forwards,	16 feet 6 inches.
" " aft,	17 " 6 "
" " mean,	17 "
Displacement at that draft,	2176 tons.
Midship section immersed,	486·55 square feet.

Speed and Slip of Screw.—The Massey's patent log, (belonging to the U. S. Coast Survey,) was unfortunately lost overboard on the third day out. After that time, therefore, no means existed of ascertaining the true speed of the ship. The chip log employed was evidently unreliable, giving about the same indication when the engines were making $16\frac{1}{2}$ and $20\frac{1}{2}$ revolutions per minute. The following data are the only ones obtained on the trial which can be relied on:

July 1st, 9 to 12, A.M.—Revolutions of engines by counter, 3780, or advance of propeller,	191,268 feet.
Massey's log showed $23\frac{3}{8}$ knots of 6120 feet, or advance of ship,	146,125 "
Slip of screw, 23 per cent.,	= 45,143 "

Sea smooth, light wind ahead.

July 1st, 5 to 8, P. M., revolutions of engines,	3420	
Distance run by Massey's log,	$21\frac{1}{4}$ knots.	
Advance of propeller,		173,962 feet.
" " ship,		130,050 "
Slip of screw, 25·23 per cent.,		= 43,912 "

Wind ahead, sea nearly smooth.

July 2d, 8 to 12, A. M., revolutions of engines,	4320	
Distance run by Massey's log,	$29\frac{1}{4}$ knots.	
Advance of propeller,		218,592 feet.
" " ship,		179,010 "
Slip of screw, 18·1 per cent.,		= 39,582 "

July 7th, in Delaware river, distance run as follows:—

Distance by shore-marks from Breakwater to Navy Yard,		101·50 stat miles.
By adverse tide, 8 hours; less favorable tide, 4 hours, or 4 hours of current at two miles per hour, .		8
Real distance run, .		109·50
Revolutions of engine, . .	14,522	
Advance of propeller, . .		734,813 feet.
" " ship, . .		578,160 "
Slip of screw, 21·3 per cent., . .		= 156,653 "

It will be observed that the best speed noted above was 8 knots per hour, at which time the pressure of steam was $16\frac{1}{2}$ lbs.; vacuum 21 inches, and revolutions 21 per minute, with light wind ahead.

With proper coal and good firing, there is, therefore, no doubt that a speed of 9 knots per hour may be easily maintained in smooth water, at ordinary load draft.

Average Performance at Sea under Steam Alone.

Date.	Hours steaming.	Steam Pressure in Cylinders in pounds.	Vacuum at Cylinders in inches.	Throttle open.	Cutting off at from comt. stroke inches.	Revolutions per minute Eng.	Revolutions per minute Pro.
July 1.	17	11·9	21·5	$\frac{3}{4}$	26	19·9	44·8
" 2,	13	9·3	21·5	$\frac{1}{2}$	26	18.	40·5
" 3,	20	12·1	22·7	$\frac{1}{2}$	26	20·1	45·3
" 5,	12	13·	23·	$\frac{3}{4}$	26	19·3	42·4
" 6,	12	9·6	22·9	$\frac{5}{8}$	26	17·6	39·6
" 7,	13	13·6	23·2	$\frac{3}{4}$	26	20·6	46·3

Best Performance at Sea under Steam Alone.

Date.	Steam Pressure in Cylinders in pounds.	Vacuum at Cylinders in inches.	Throttle open.	Cutting off at from comt. stroke inches.	Revolutions per minute. Eng.	Revolutions per minute. Prop.
July 1,	18·	22·5	$\frac{3}{4}$	26	22·5	50·6
" 2,	14·	22·	$\frac{1}{2}$	26	21·	47·3
" 3,	16·	23·2	$\frac{5}{8}$	26	22·	49·5
" 5,	17·	23·5	open	26	21·1	47·5
" 6.	9·	23·5	$\frac{2}{3}$	26	20·	45·0
" 7.	13·	23·8	open	26	20·8	46·8

Performance under Sail.

Various trials were made of the capabilities of the ship with the wind in different directions. It was found that the propeller uncoupled would revolve at a speed varying from 9 to 12 per cent. from that due to the velocity of the ship; the resistance therefore, in sailing, offered by the propeller is trifling. With the propeller coupled and dragging, a reduction in speed of ship from $5\frac{3}{4}$ to $4\frac{1}{8}$ knots or 29 per cent. was experienced. The ship was found to steer well, and to tack easily with a light breeze.

On the Results of a series of Experiments on the Decomposition of Water by the Galvanic Battery, with a view to obtain a constant and brilliant Lime Light. By the Rev. N. J. Callan, Prof. of Nat. Philos. in the Rom. Cath. Coll. Maynooth.*

Soon after I had discovered the nitric acid and cast-iron battery, and before I had completed the large one which I made for the College, I began to make experiments on the decomposition of water with a view to obtain a lime light which might answer for light-houses. I soon succeeded in obtaining a steady and brilliant light. In a paper on our new galvanic battery, dated April 6, 1848, and published in the *London Philosophical Magazine* of the following July, I stated that "I got the lime light by igniting mixed gases as they were produced by the decomposition of water and throwing the flame on lime." I believe I was the first who obtained a constant lime light by means of the galvanic battery. My experiments were frequently interrupted on account of the state of my health. They were at one time suspended for more than two years, and several times for five or six months. The same cause which obliged me to interrupt them, now compels me to bring them to a close before I could complete all the experiments I intended to make. These experiments have led to the following results:—First, a new apparatus for applying with perfect safety the mixed gases, oxygen and hydrogen, to the production of a flame of the most intense heat, which, when thrown on lime, produces a most dazzling light. Secondly, a new voltameter, to which a common jet may be screwed, and the gases inflamed as they issue from it, without the smallest risk of injury, and by which the full decomposing effect of a battery of a hundred or five hundred pairs, arranged in one series, may be produced without exhausting the power of the battery more rapidly than if it contained only three or four cells. Thirdly, a new negative element, far cheaper, far more durable, and one which may be made to act more powerfully than the platinized silver used in Smee's battery. Fourthly, a new mode of protecting iron against the action of the weather and of various corroding substances, so that iron thus protected may be used for all the purposes to which sheet lead and galvanized iron are applied. Fifthly, a method of producing a brilliant intermittent lime light by means of a small galvanic battery. Sixthly, a new mode of exhibiting the dissolving views by means of the lime light. Lastly, a new sine galvanometer, which is the only instrument yet made by which very powerful galvanic currents can be measured.

The first result was a new apparatus for applying with perfect safety the mixed gases to the production of the oxyhydrogen flame and lime light. In my first experiments on the decomposition of water, I made use of a glass vessel containing dilute sulphuric acid and four parallel plates of platinized platina, each having a surface of about 14 square inches. The mouth of the vessel was stopped by a thick piece of wood, through which the wires from the electrodes passed. In this wood was cemented a tapped brass nut, to which a stop-cock and Hemming's jet might be screwed; the mouth of the vessel was made air-tight by cement.

* From the Lond., Edin., and Dub. Philos. Mag., Feb., 1854.

I soon found that with a glass vessel the use of Hemming's jet was unsafe. On one occasion, when I employed twenty 6-inch cells of our cast-iron battery, the Hemming's jet did not let out all the gases produced in the vessel; for after breaking the connexion between the battery and electrodes, the gases continued for some time to issue from the jet and kept up the lime light, although the battery had not worked for more than a minute or two. Had I allowed the battery to work nine or ten minutes, the gases would have been condensed within, and would have burst the vessel; I therefore saw that I must either get the gases separately, or devise some means by which the mixed gases might be safely inflamed, and might at the same time pass without much resistance from the glass vessel. I attempted both. To get the gases separate, I put a plate of porous earthenware between the electrodes so as to form two air-tight cells. I thus succeeded in obtaining the gases separate; but finding so much difficulty in making the cells air-tight, I gave up the idea of looking for the gases separately. In order to avoid dangerous explosions in igniting the mixed gases, and at the same time to allow them to pass freely to the jet, I sent them through water contained in an iron vessel, to the top of which was screwed the jet belonging to our large gas microscope and polariscope. The first iron vessel which I used was about $5\frac{1}{2}$ inches high and 2 inches in diameter; its sides were an inch thick. This vessel was found to be too small. On two occasions, all, or nearly all the water was thrown out of the vessel through the jet; the flame went back and exploded the gases in the bags. On these two occasions the pressure was very irregular. The quantity of the gases contained in the bags was too small to be forced out by weights on the pressure boards. They were driven through the jet by a person who pressed frequently and violently on the bags with his arm. This violent and irregular pressure forced the water through the jet. Had the pressure been uniform, it is probable the explosions would not have occurred. Dangerous explosions can happen only because the water may be gradually ejected from the iron vessel through the jet or into the gas bag; or because, when the gases are made to pass rapidly through water in large quantities, there is a continuous series of large bubbles rushing through it; and should the uppermost bubble be ignited, the flame might possibly descend through the series of bubbles without being extinguished by the surrounding water. In the apparatus which I have made, a dangerous explosion from any of these causes is impossible. The apparatus consists of two wrought iron vessels of unequal size. The smaller is the one already described. The large one is about $7\frac{1}{2}$ inches high and 4 inches in diameter; its sides are about $\frac{7}{8}$ths of an inch thick. On the top of the vessel is laid a collar of thick vulcanized India rubber. An iron plate about $\frac{3}{4}$ths of an inch thick is then screwed down to it by five iron bolts. The vessel is thus made air-tight. The top of this vessel is connected by an India rubber tube with the bottom of the small one; the bottom of it is connected by a similar tube with the gas bag, gasometer, or voltameter. The two vessels are nearly filled with water. The gas is sent into the bottom of the large one, ascends through the water, passes through the tube to the bottom of the small one, then through the water, and issues from the jet screwed to the top of the small vessel. Since the two

vessels are of very unequal size, it is impossible that all the water should be carried out of both at the same time by the stream of the gases; and should an explosion occur after the small vessel became empty, the flame would be stopped by the water in the large vessel. In each vessel the gases are made to pass through wire-gauze or perforated zinc, or through small pieces of porous earthenware, in order to break the bubbles, and thus prevent the gases from ascending in a continuous series of large bubbles. To prevent the water from being driven into the gas bag or voltameter which may be used, I have put a strip of vulcanized India rubber across the hole through which the gases enter into each of the iron vessels. The strip of vulcanized India rubber acts as a valve, which opens inwards and admits the gases into the vessel; and when pressed outwards by the expansive force of the exploded gases, it closes the hole and prevents the escape of any part of the water into the gas bag or voltameter. Hence it is evident that in our apparatus dangerous explosions cannot happen, either because the water may be gradually ejected from the iron vessel through the jet or back into the gas bag, or because the flame might ascend through a continued series of bubbles of the mixed gases. The size of the iron vessels should be in proportion to the quantities of mixed gases inflamed, and to the length of time the flame is kept up. Should a person wish to continue the lime light for a very long time, he would do well to have two pairs of vessels and change them every hour or half-hour, or examine occasionally whether the water was carried away by the stream of the gases. I have several times tried the large vessel alone without any accident, although the gases above the water occasionally exploded when they were not pressed through the jet with sufficient force. I believe that this vessel may be used alone without danger; but I would recommend in all cases the use of two vessels, one of which should be a good deal larger than the other, that the small one be about 3 inches in diameter and 6 inches high, and that the experimenter examine occasionally whether they contain water. I always kept the gas bag in a place in which, though an explosion should occur, no injury could be done to any person. On one occasion I filled the small iron vessel with shot instead of water. The shot prevented the return of the flame for a little time, but after five or six minutes the gases in the small vessel and in the upper part of the large one exploded, but the flame did not descend through the water. The mixed gases which I employed were always obtained by the decomposition of water. One of the gas bags commonly used for the gas microscope and polariscope may be filled in two or three hours by a cast iron battery of six cells and as many zinc plates, each 6 inches square. I always employed nitrosulphuric acid which had been previously used. Acid which had been used before, answers very well for producing decomposition; because, for this effect, the cells of the battery must be so arranged that its intensity will not exceed that of three, or at most four cells in series. When the gases are obtained by the decomposition of water, they are always mixed in the proportions in which they answer best for the production of intense heat and light; hence, when it can be done without danger, it is better to produce the lime light by the decomposition of water than by getting the gases into separate vessels, and then mixing them in the proper pro-

portions. With half a dozen of cells of the cast-iron battery, a voltameter, a pair of gas bags, and the apparatus just described, the gas microscope and polariscope, as well as the dissolving views, may be exhibited. But the experimenter must, until he acquires experience, proceed with great caution.

The second result was a new voltameter, to which a common jet may be screwed, and the mixed gases inflamed as they issue from it without the slightest risk of injury, and by which the full decomposing power of a battery of 100 or 500 cells arranged in one series may be exerted without exhausting the power or the battery more rapidly than if it consisted of three or four plates. This voltameter is new in every respect,—in the material of which it is made, in the manner in which the electrodes are connected with the opposite ends of the battery whilst the vessel remains air-tight; new in the metallic plates employed as electrodes, and in the arrangement of these plates; finally, new in the fluid which is used for the decomposition. After having succeeded in making the apparatus for preventing dangerous explosions, I found that a glass vessel was totally unfit for a voltameter such as I wanted: first, because it is extremely difficult to make a glass vessel permanently air-tight; secondly, because it is not sufficiently strong to bear the pressure of the condensed gases; thirdly, because on one occasion, by unscrewing a bag which I had filled with the mixed gases, a spark which was produced by accidentally breaking connexion with the battery, or by the contact and separation of the electrodes, inflamed the gases and caused an explosion which shattered the vessel. I fortunately escaped unhurt. The vessel which I have used for nearly the last two years is made of wrought iron about an inch thick. Its form is cylindrical, its height about 16 inches, and its inside diameter 6 inches. It is open at the top, which was turned flat in a lathe; the bottom is laid on a circular piece of wood, which is placed on an iron plate about $\frac{5}{8}$ths of an inch thick and 8 inches square. On the top of the vessel is laid a thick collar of vulcanized India-rubber, and on this an iron plate similar to the one under the bottom. In the top plate there are two holes, to one of which a stop-cock is adapted; to the other is fitted, air-tight, a perforated piece of brass which projects about an inch and a half above the plate. The hole in this brass is large enough to admit a thick wire. The upper part of the brass is tapped in order that a brass cap may be screwed to it, to prevent the escape of the gases through the hole. When the electrodes are placed in the vessel, one of them is connected by solder or pressure with the inside; to the other is soldered or riveted a copper wire, which passes through the hole in the brass screwed into the top iron plate. By means of four $\frac{3}{4}$-inch bolts of iron, which pass through the top and bottom iron plates, the top plate is screwed down on the India-rubber collar. The wire is then wedged against the side of the hole in the piece of brass, and the brass cap is screwed on. The board between the bottom of the vessel and under iron plate, and the India-rubber collar between the top and upper iron plate, insulate both plates from the iron vessel. The outside of the vessel is connected with one end of the battery, and the top or bottom plate with the other. Thus the two electrodes are connected with opposite ends of the battery; and if acidulated

water, or water containing any of the alkalies, be poured into the vessel, it will be decomposed by the voltaic current. If a stop-cock to which a jet is attached be screwed to the top plate, the gases will rush through the jet and may be ignited without the smallest danger, for the explosion of the gases contained within can never burst a vessel of such strength. I have had frequent explosions without producing any injurious effect, though the vessel was sometimes nearly half-filled with the mixed gases. Before discarding the glass vessel, I began to use sheet iron instead of platina electrodes. I found that when the intensity of the battery exceeded that of three or four cells, the power of the battery was soon exhausted; hence in using a battery of eighty cells, I was obliged to arrange them in twenty rows, each containing four cells, and to connect all the end zinc plates so as to form one, and all the iron cells at the other end so as to act as one. I also found, that, to obtain the full effect of the decomposing power of the battery, the acting surface of each electrode should be as large and a half as the acting surface of the zinc in each circle. Hence about 9 square feet of sheet platina, which would cost nearly 30*l.*, are necessary for a voltameter large enough for a battery of eighty 4-inch plates, when they are properly arranged for decomposition. Platina plates are not only very expensive, but they are also very easily torn and rendered unfit for use. I used a pair of sheet iron plates about 4 feet long and 9 inches broad. To one of them I soldered a piece of thick sheet copper, and to the other a thick copper wire. I then covered one of them with linen, and rolled the two into a coil about 4 inches in diameter. I had then two plates of iron, nearly 3 square feet in surface, separated from each other by the interposed linen. The coil was put into the iron vessel. The copper plate soldered to one of the iron plates was connected with the inside of the vessel, and the copper wire attached to the other was connected with the perforated brass in the top. The vessel was then filled with a solution of carbonate of potash. I employed this solution in order to prevent the oxygen from attacking the positive electrode. When the plates were connected with the opposite ends of a battery, the water was rapidly decomposed, and a considerable quantity of the mixed gases obtained. From the intensity of the lime light produced by the gases, it appeared that the potash effectually prevented the combination of the oxygen with the positive electrode. The iron plates worked well for about an hour; the decomposition then began to decline very rapidly, though the battery was in good order. I then took up the iron plates, separated them from each other, and removed the linen cover. One of the plates was coated with a non-conducting black deposit. This was the first time I found such a deposit on either of the plates; on all former occasions they were separated from each other by slips of wood or gutta percha. I afterwards got a pair of lead plates, which I rolled up in the same way as the iron plates; they, too, ceased to act after some time, because one of them became covered with a black non-conducting substance. I then got four concentric hollow cylinders make of sheet iron $\frac{1}{8}$th of an inch thick, so that the largest of them fitted in the iron vessel. The first or innermost one was connected with the third, and the second with the fourth; they were separated from each other by wedges of wood, and also insulated from the bottom of the vessel. The

first and third were connected with the top plate, and the second and fourth with the side of the vessel. These acted tolerably well; but when I used a pair of lead electrodes with a battery of ten 6-inch plates, the lime light was considerably larger and more steady than when I employed the iron cylinders. Hence I resolved, if possible, to give up the use of iron electrodes. I saw at the same time that lead plates would not answer; for when they are placed near each other, a slight pressure, and sometimes even their own weight, brings them into contact with each other. It then occurred to me to try strong tin plates immersed for a few seconds in melted lead, or in a liquid alloy of lead and tin, in which alloy the quantity of tin would be small compared with that of lead. Not having any new tin plates at hand, I cut up some old tin vessels, and made three plates, each nearly 4 inches wide and 6 long. I coated one of them, by means of a soldering iron, with an alloy, containing about seven parts by weight of lead and one of tin; and another with an alloy containing about three parts of lead and one of tin. On the third, after being coated with the alloy, I sprinkled some powdered sulphur, and held the plate over the fire until the sulphur was inflamed: the plate was thus covered with a black coating of burnt sulphur. I then tried each of the three, and also a plate of lead about the same size, as the negative element of a nitric acid battery; that is, I put each successively, instead of platina or cast iron, into a porous cell containing nitrosulphuric acid. Each of the three acted far more powerfully than the lead plate. The plate coated with the alloy containing the largest proportion of lead acted better than the one whose coating contained least lead, but not so well as the plate on which sulphur was burnt. This last plate produced a galvanic current very nearly equal to that of a platina or cast-iron plate. I afterwards put into concentrated nitric acid a piece of the tin which was coated with the alloy of lead and tin, and with sulphur, a piece of one of the alloys of lead and tin and a piece of lead, and left them in the acid for about twenty hours. On taking them out of the acid, I found that a good deal of the lead had been dissolved, but the piece of coated tin and the alloy were merely blackened on the surface. From the results of these experiments, it is evident that tin plates, coated with an alloy of lead and tin, in which the proportions of tin is small, are more passive in nitric acid, less oxidable, and consequently better suited for the electrodes of a voltameter than lead plates. The tin plates are stronger and more elastic than leaden ones, and therefore are not so easily brought into contact with each other. It was in last March or April that I discovered that tin plates coated with an alloy of lead and tin, are less oxidable than lead. Since that time I have in all my experiments used the coated tin plates as electrodes. I have arranged these electrodes in two ways; in one way for a battery of low intensity, and in another for batteries of high intensity, or of a large number of cells all in one series. In one of the former arrangements there were twenty plates, each 12 inches by 4; they were all parallel, and separated from each other by slips of wood about $\frac{1}{16}$th of an inch thick. Ten of them were connected with one end of the battery; these were of course the alternate plates; the other ten were connected with the opposite end. The acting surface of each electrode, including both sides of each plate, was something more

than 3 square feet. The electrodes for batteries of high intensity are also parallel and separated from each other, about one-sixteenth of an inch, by a non-conductor. But the two outside or terminal plates only are connected with the battery; one with the negative, the other with the positive end. The terminal plate, which is connected with the top iron plate of the voltameter, must be covered on the outside by a non-conductor, otherwise the voltaic current would pass to the side of the iron vessel, and would not pass through the plates and fluid interposed between the two outside or terminal plates. The cells between each pair of plates must be made nearly water-tight, and must be open only on the top, in order that when the terminal plates are connected with the battery, the voltaic current may have no way of passing from one end of the battery to the other but through the interposed plates and fluid. In each plate there should be a small hole near the bottom, that the cells may always remain nearly filled with the fluid. The fluid should never rise above the upper edge of the electrodes, otherwise a great part of the galvanic current would be transmitted by it from one terminal plate to the other without passing through the interposed plates or fluid. The number of cells formed by the interposed plates should be about one-fourth of the number of cells in the battery. Thus for a battery of 12 cast-iron cells, there should be 3 cells or 2 plates between the two terminal plates. For a battery of 100 cast-iron cells in series, there may be 25 decomposing cells or 24 interposed plates. A battery of 100 cells has twenty-five times the intensity of a battery of 4 cells, therefore the current from it will overcome twenty-five times as much resistance as the current from 4 cells, and will pass through 25 decomposing cells successively as freely as a current from a battery of 4 cells will pass through a single decomposing cell. If the current from a battery of a hundred well *insulated* cells be sent through 25 decomposing cells, and afterwards through the coil of a galvanometer, which coil is made of thick copper wire, it will be found that the deflexion of the needle will be equal to that which will be produced by a current from a battery of 4 cells passing through one decomposing cell and through the coil of the same galvanometer. Hence there is as much of the mixed gases produced in each of the 25 decomposing cells as in the single cell through which the current from the battery of four cells passed, that is, twenty-five times as much of the mixed gases as is produced by a battery of four cells. Hence the full decomposing power of a battery of a hundred cells is exerted; and because the intensity of the current is reduced to that of a battery of four cells, the power of the battery is not exhausted more rapidly than if it consisted of four cells in series. If the current of a battery of a hundred cells in one series were sent through the electrodes as they are commonly arranged, the power of the battery would be exhausted about twice as soon as if the current passed through the electrodes arranged for batteries of high intensity, and the twelfth part of the full decomposing power of the battery would not be effective. To those who wish to show with the same battery the deflagrating power of the voltaic current, the coke light, and the decomposition of water, and the lime light, an arrangement of the electrodes similar to that which has been just described will be useful, because a battery arranged for intensity will answer for all these effects.

But when a battery is put up for the sole purpose of decomposing water, it is better to arrange the cells in such a way that the intensity may not exceed that of four cells in series; because if a battery of 100 cells be arranged in series, a single bad porous cell or bad zinc plate will diminish considerably the power of the entire battery; but if the 100 cells be arranged in twenty-five rows, each containing four cells, and all the terminal zinc plates be connected so as to act as one plate, and all the end iron cells be connected so as to act as one, a bad porous cell or zinc plate will diminish the power only of the row to which it belongs, but not of the other rows.

(To be Continued.)

For the Journal of the Franklin Institute.

Particulars of the Steamers Gen. Santa Anna and Iturbide.

New York.—Hulls built by J. A. Westervelt & Co. Machinery by T. H. and E. Faron. Intended service, Mexican Government.

HULL.—			
Length on deck,		160 feet.	
Breadth of beam at midship section,		28 "	4 inches.
Depth of hold,		14 "	3 "
Length of engine and boiler space,		40 "	
Draft of water at load line,		11 "	
" " below pressure and revolutions,		11 "	
Tonnage,	540.		
Area of immersed midship section at this draught,		226 feet.	
Masts and rig—	Barque.		
ENGINES—oscillating.			
Diameter of cylinder,			36 inches.
Length of stroke,		2 feet.	9 "
Maximum pressure of steam in pounds (estimated)	30.		
Steam cut off at half stroke,			
Maximum revolutions per minute,	35.		
Weight of engines *in pounds*,	80,000 estimated.		
BOILERS—Two—single return flue.			
Length of boilers,		18 feet.	3 inches.
Breadth "		8 "	6 "
Height " exclusive of steam chimney,		9 "	6 "
Weight of " *in pounds*, 50,000—Estimated—without water.			
Number of furnaces in each boiler,	2.		
Length of grate bars,		6 feet.	
Area of upper flues in each boiler,			1008 sq. ins.
" lower " " "			1225 "
Length of flues,		21 feet.	
Fire surface,		1800 "	
Diameter of smoke pipes,		4 feet	9 inches.
Height " "		37 "	
Description of coal,	Bituminous.		
Consumption of coal per hour (estimated)	900.		
PROPELLER.—			
Diameter of screw,		10 feet	3 inches.
Length of blades,		2 "	7 "
Pitch of screw,		17 "	
Number of blades,	3.		
Average revolutions per minute,	90.		

Remarks.—Floor timbers at throat, *molded* 1 foot 2 inches. *Sided* 7 × 8 inches. Distance of frames *apart at centres*, 2 feet. Hull, of live oak; floors not filled in solid.

For the Journal of the Franklin Institute.

Particulars of the Steamer Clyde.

Hull built by Scott, Sinclair & Co. Machinery by the same firm. Intended service, New York to Glasgow.

HULL.—			
Length on deck,		250 feet.	
Breadth of beam,		31 "	3 inches.
Depth of hold,		24 "	
Draft of water at load line,		17 "	
" " below pressure and revolutions,		15 "	
Masts and rig—	Three masted brigantine.		
ENGINES—Inclined athwartship—Geared $2\frac{1}{2}$ to 1.			
Diameter of cylinder,			52 inches.
Length of stroke,		3 feet.	10 "
Pressure of steam in pounds,	12.		
Revolutions per minute,	34.		
BOILERS—Four—tubular.			
Number of furnaces,	12.		
Description of coal,	Bituminous.		
PROPELLER.—			
Diameter of screw,		12 feet.	
Pitch of "		15 "	
Number of blades,	3.		

Remarks.—Frames, *shape and dimensions* ⅂ $5\frac{1}{4} \times 3 \times \frac{1}{2}$ inches; *distance paart at centre* 15 inches. Plates, *thicknesses*, 1 inch to $\frac{5}{8}$ths. Keelsons, *number and dimensions* 3, one a box keelson, and two ⅂ on the sides. Is cieled with wood to turn of bilge. Is clincker built and abut riveted.

Translated for the Journal of the Franklin Institute.

New process in the making of Glass for Achromatic Lenses for Telescopes.

By M. DE PEYRONY.

Marshall Vaillant presented in the name of the author, M. de Peyrony, Captain of Engineers at Cherburg, a memoir upon a new process in the manufacture of the glass of which the lenses of astronomical telescopes are made.

In the present state of this manufacture, the mass of the glass having been brought to a state of fusion in the crucible, the material is simply stirred to make it homogeneous and drive out the air included in it; but this double object is never completely obtained, and the stirring, as it is performed, itself occasions the formation of numerous striæ, which compels the rejection of a large part of the glass taken from the crucible, as unfit for the formation of lenses. Hence the difficulty of obtaining lenses of large dimensions.

M. de Peyrony thinks that he has found the solution of this difficulty; that is to say, a way of making glass free from faults, by giving to the crucible containing the fused mass, a somewhat rapid motion of rotation around a vertical axis; the centrifugal force will, according to him, unite the air bubbles towards the centre of the glass, while the striæ made by

stirring, will, for the most part, disappear, and those that remain will be circular, and be productive of no inconvenience, if care be taken to make the axis of the primitive mass, the axis of the lenses.

Comptes Rendus de l'Academie des Sciences, vol. xxxviii, p. 874.

REMARKS.—The improvement by this process is not patent. The central part of the mass which it is proposed to throw away, is precisely the part which it is most desirable to preserve. And the idea of constructing a lense around an axis of the mass which is cut out as good for nothing, is probably more remarkable for novelty than excellence.—ED.

For the Journal of the Franklin Institute.

Particulars of the Steamer Cleopatra.

Hull built by Wm. Denny and Brother, Dumbarton. Machinery by Tullock & Denny. Intended service, Liverpool to Portland and Montreal.

HULL.—			
Length on deck,		228 feet.	
Breadth of beam at midship section,		32 "	
Depth of hold,		25 "	2 inches.
Length of engine and boiler space,		63 "	
Tonnage,	1138.		
Masts and rig,—	Ship.		
ENGINE.—Vertical beam.			
Diameter of cylinder,			62 inches.
Length of stroke,		4 feet	6 "
Maximum pressure of steam in pounds,	10.		
Weight of engine,	150 tons.		
BOILERS—Two—tubular.			
Length of boilers,		9 feet.	
Breadth "		12 "	9 inches.
Height " exclusive of steam chimney,		12 "	4 "
Weight of " without water,	150 tons.		
Number of furnaces,	8.		
Length of grate bars,		6 feet.	6 inches.
Number of tubes,	580.		
Internal diameter of tubes,			$3\frac{1}{4}$ inches.
Length of tubes,		6 feet.	
Diameter of smoke pipes,		5 "	11 inches.
Height, "		40 "	
Description of coal,	Bituminous.		
PROPELLER—			
Diameter of screw,		14 feet.	
Pitch,		18 "	
Number of blades,	2.		

Remarks.—Frames, *shape and dimensions* ⅂ 5 by 3 inches and $\frac{9}{16}$ in.; *distance apart at centres*, 18 inches—Plates *thicknesses* $\frac{3}{4}$ $\frac{11}{16}$ $\frac{9}{16}$ and $\frac{1}{2}$ inches. Has 6 water-tight bulk heads, clincker built, with abut riveted.

Translated for the Journal of the Franklin Institute.

Lighting by Electricity. Letter of MM. DELEUIL & SON, to M. ELIE DE BEAUMONT.

We communicated to the Academy, some time ago, a note in reference to the electro-lighting of the Napoleon Docks. M. Regnault, the

Director of the telegraph of the Rouen Railroad, who took charge of this lighting, has communicated to us the statement of the expense, of which we herewith send you the details.

We thought that every thing connected with this lighting would be favorably received by the Academy. The apparatus which worked for four consecutive months with great regularity, were composed each of a battery of fifty Bunsen elements of large size.

The expense per day apparatus, was as follows:

Wages of the workmen,	4·50	francs.
Mercury,	5·	"
Zinc,	4·50	"
Charcoal points,	1·40	"
Nitric Acid,	1·80	"
Sulphuric Acid,	1·84	"
	19·04	" ($3·80.)

The expense of lighting 400 workmen was, then, 38·08 francs ($7·62) per evening, or 1·9 cents per man. The economy is considerable, and the work can be done without danger and with a regularity which cannot be obtained by any other means.

The Perpetual Secretary remarked, that electro-lighting, which could be very cheaply established on ship-board, and which is not, like other systems of lighting, liable to be extinguished during a storm, would be very advantageous for preventing those collisions by night, which are so frequent, and generally so disastrous, and to which attention has been called by a recent event.—*Comptes Rendus de l'Academie des Sciences, (Paris,)* 1*st May*, 1854.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, July 20, 1854.

Dr. B. H. Rand, President, pro. tem., in the chair.

Owen Evans, Corresponding Secretary, pro tem.

Isaac B. Garrigues, Recording Secretary.

The minutes of the last meeting were read and approved.

Letters were read from the Royal Institute of British Architects, London, and the Smithsonian Institution, Washington City, D. C.

Donations to the Library were received from the Smithsonian Institution, Washington City, D. C.; John McRea, Esq., Charleston, S. Carolina; Paul K. Hubbs, Esq., California; the Pennsylvania Legislature: B. F. Palmer, Esq., Prof. John F. Frazer, and the Councils of the City of Philadelphia.

Donations to the Cabinet of Minerals from James H. Bulkley, Esq.

The periodicals received in exchange for the Journal of the Institute were laid on the table.

The Treasurer's statement of the receipts and payments for June was read.

The Board of Managers and Standing Committees reported their minutes.

Resignations of membership in the Institute, by two gentlemen, were read and accepted.

New candidates for membership in the Institute (4) were proposed, and the candidate proposed at the last meeting was duly elected.

Washington Jones exhibited to the meeting some specimens of scale, or incrustation, taken from the boiler of a coasting steamer. One piece about twelve inches long, by eight wide, and about three-eighths thick, was formed on the outer portion of the furnace crown, and distinctly showed the form of that part of the boiler, with each rivet head and the joinings of the sheets. The scale had been deposited in layers that were of various tints, derived from the coloring matter extracted from the substances (such as saw-dust of mahogany, &c.,) that had, from time to time, been put into the boiler to prevent the deposit of scale. Another piece, of irregular shape, had been taken from the steam chimney. It is well known that scale is a non-conductor of heat. It forms most rapidly, as a necessary consequence, upon those parts of the boiler where the heat and the evaporation is the greatest, and thus increases the liability these parts have to become overheated or burned.

Mr. Jones also presented a stay bolt taken from the smoke pipe, where its head had been for over two years exposed to jets of exhaust steam. The part of the head against which the steam impinged, had been cut or worn away by its action; the texture of the iron was close, and the wasted part was as smooth as if cut with a keen tool.

Mr. Jones remarked that the proper construction and maintenance of steam boilers in a safe condition, should be of special importance not only to engineers, but to the whole community. No part of the apparatus requires closer attention. As a class, our steamboat engineers are fully competent to discharge the duties belonging to their post; but, occasionally, the desire to make a quick run, induces them to carry a little higher steam, and to "blow out" less frequently, a practice to be deprecated, as it is almost sure to bring upon them the labor of "scaling," as well as risking the efficiency of the boilers.

Mr. Jones also called the attention of the members to a simple contrivance for communicating rotary motion without the aid of toothed wheels or belts, invented by Mr. Joseph Thatcher, of Philadelphia. It is believed to be new, and consists of a rigid bar whose ends are fitted to the pins of cranks secured on the shafts that are intended to transmit and receive the motion. In the middle of the bar is a slotted hole, of a length rather more than the throw of the cranks. A stationary pin is secured in line with the centres of the two shafts, and (in the present instance,) equi-distant from them. Upon this pin the slotted lever is free to slide in the direction of its length. When one shaft is turned from right to left, the crank pin carries the attached end of the bar with it; the fixed pin in the slotted hole preventing any motion sideways, the other end of the bar is obliged to move in an opposite direction, or from left to right; the motion of the bar gradually changes from a vibratory, to one in the direction of its lengths, and vice versa. The model shown worked freely, no undue friction being apparent.

The inventor has applied this apparatus to gas metres, and his application is at present under consideration by the Committee on Science and the Arts.

COMMITTEE ON SCIENCE AND THE ARTS.

Report on Atkins' Self-Raking Automaton Reaper and Mower.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination, "a Self-Raking Automaton Reaper and Mower," invented by Mr. Jeurum Atkins, of Chicago, Illinois—REPORT:

That they have carefully examined its structure, and have also made trial of it in actual use in grain and grass, in a manner adapted to test its capability of doing its work in very unfavorable circumstances: the field on which it was tried being very uneven, and the rye that was cut much beaten down and entangled. In the general form and arrangement of its cutting apparatus, this machine does not differ materially from many others in common use; and therefore, requires no description or remark with regard to these parts. Its peculiarity consists in an apparatus, termed "Self-Raking," which by an ingenious arrangement that cannot well be explained intelligibly, without the aid of a working model, causes a rake armed with a few long fingers to sweep at regular intervals across the receiving platform, from which it gathers the cut grain and deposits it in bundles ready for binding on the stubble in the rear of the machine, out of the track of the horses when they come round on the next swarth. The combination used to produce these results, appears to be as simple as the complex movements required will permit; being composed essentially of a few jointed levers which receive their motion from a pivot inserted in the disk of a revolving wheel. These peculiar motions bear a striking resemblance to those of the human arm at the shoulder and elbow joints, in the act of being placed a-kimbo: now, by supposing a bundle of straws to have been gathered by a scraping motion of the hand, and held by compression between the fingers and the hip, while the person turns on one heel quarter round; then dropping the bundle by extending his arm to an angle of about 45° with his erect body; and while his arm is thus extended, turning on his heel back to his original posture, there to recommence these manœuvres, a pretty correct notion of the movements of this curious apparatus may be obtained. The intention of the contrivance is to save the labor of a man who must be employed on other reaping machines to throw the cut grain off the platform on which it falls as fast as it is cut; and also to diminish the labor of the binders, who must usually follow with rakes to gather the grain into bundles for binding.

The trials made by the Committee, show that it can perform completely the duty of the first mentioned operator, and also reduces the labors of the others. In conclusion, as it is believed that this combination is new both in its form and application, it is deemed to be a proper object for the Scott's Legacy Premium, an award of which, is accordingly recommended.

By order of the Committee,

WM. HAMILTON, *Actuary.*

Philadelphia, July 13, 1854.

JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS.

SEPTEMBER, 1854.

CIVIL ENGINEERING.

For the Journal of the Franklin Institute.

Rough Notes of an Exploration for an Inter-oceanic Canal Route by way of the Rivers Atrato and San Juan, in New Granada, South America. By JOHN C. TRAUTWINE, Civ. Eng., Philad.

ERRATA.—On page 81, line 10, for Plate III, read Plate IV.

Continued from page 84.

Next morning we sat off before sunrise, our host having informed us that by so doing we should reach San Pablo late on the same afternoon, *before the rain should begin.* He was desirous that we should accept a present of cacao nuts, of his own raising, for preparing chocolate on our way; but as we had determined to press on all day without stopping to cook, we declined his offer. He would not, however, let us off before taking a cup of chocolate with him. The women had even risen long before day to prepare breakfast for us; but as habit had rendered it impossible to eat at so early an hour, we were compelled to resist their kind solicitations to partake of it. It required many protestations on our part to allay the feeling of mortification to which our refusal evidently gave rise. We were, however, most efficiently sustained by our patron, who not only assured them that we eat almost nothing, but exhibited a praiseworthy zeal in atoning for our short comings, by swallowing, at intervals between his sentences, plantains, boiled peccary, parrot, and monkey, sufficient for the whole party.* We had arranged with our sable friend to take

* Trifling incidents of this kind are mentioned, not with a view of imparting a character of personality to my narrative, but merely as confirmatory of my previously expressed experience of the hospitable disposition of the inhabitants of this region, when properly approached.

care that our boat should be safely delivered to Señor Posso, at Baudó; he having, on his part, undertaken to return her to her owner.

As our bogas had left us the day before, to have a canoe in readiness for us on the Surúcco, we engaged two or three of our host's retainers to carry our baggage across the atravesia, or pathway over the ridge.

This we found to be about three miles in length, as nearly as we could judge by the time required to walk it; namely, an hour and a half, at a very slow rate, the way being muddy, and the air extremely close and sultry.

My previous observations at the mouth of the Baudó, and along the Pepé, having fully convinced me of the futility of any canal scheme by this route, I did not consider myself at liberty to consume time in making any *exact* measurements, which, although possessing interest as solving a geographical problem, must necessarily postpone the period at which I could submit, to those in whose service I was employed, my final report as to the feasibility of this project. I therefore aimed at nothing more than to disprove the existence of the high mountain chain which has hitherto been supposed to lie between, and parallel to, the San Juan and the Pacific Coast. The non-existence of such a range is not only rendered probable by the moderate elevation at the point at which we crossed; but is, I conceive, fully demonstrated by the fact that none was visible from either the Baudó or the San Juan.

The broad level tracts to the west of the San Juan, or to the east of the Baudó, would frequently have afforded an uninterrupted view of any important elevation; especially when we were descending reaches of the river, running nearly north-west and south-east; in the same manner that those of the Atrato had enabled us to trace the course of the Western Cordilleras, at a far greater distance.

The ridge of partition here presents a character essentially different from that of the atravesia at the head of the Pató. We found the rate of ascent from the house to near the summit, to be very gradual. Throughout this portion, the pathway runs nearly parallel to a rivulet-branch of the Pepé, the fall of which is by no means precipitous. Its bed does not show the round siliceous pebbles of the main stream, but merely flat ones of the indurated gray clay. At the head of this little branch we came to the ridge itself, which is but a trifling hill, apparently less than 150 feet in height, where the path crosses it; and even some 30 or 40 feet lower within a few rods distance.

Large canoes are frequently dragged across here, with very little trouble. Two had thus passed the day before. We did not see any siliceous pebbles in crossing the western slope of this ridge, which consists chiefly of gray and yellow clay. The pathway down the eastern slope is steeper than on the western; and at points where the stratification was exposed to some depth, we found the lowest strata to be perfectly formed hard rock, consisting of cemented sand, gravel, and paving pebbles. Their strike appeared to be about N. E. and S. W., with a dip to the S. E. of about 55 degrees. We saw no boulders on either side.

At the east foot of the hill we found our men waiting with a boat, in a small creek, called the Arastradéro, tributary to the Surúcco; but as the stream then afforded too little water to float the loaded canoe, we had to

follow it about half a mile down, on foot, before we could embark. Its name is derived from the Spanish "arastrar," to drag; and probably has reference to the portage across which canoes are dragged. It runs about eight miles before uniting with the Surúcco; and throughout this distance, it is but barely adapted to large canoes. After receiving the waters of the Surúcco, it becomes a very respectable ranchada stream; while the addition of the Basurú, at some four and a half miles above the entrance into the San Juan, gives it an ordinary width of 50 feet, with a mid-channel depth of 4 or 5 feet. Before reaching the San Juan, the average width becomes about 100 feet; but it is much obstructed in places by logs and bars.

I have before alluded to the partition ridge as having, in my opinion, interposed a barrier to a further dispersion westward of the gold bearing drift, or diluvium, which, descending from the Western Cordilleras, has, like an immense flood, swept over the face of the intermediate region, showing itself at all points except where the more recent alluvial accumulations have covered it. In proof of this, we descended the Arastradéro but a very short distance before meeting with the gold-bearing clay and gravel.

We stopped for a short time at the hut at which our men had, on the preceding day, obtained the boat we were now using; and on my remarking to the colored master of the house, that the appearance of the soil indicated the presence of gold, he told me that the women of his family were at that moment washing for it in the immediate vicinity; and on my expressing a desire to see the operation, he somewhat reluctantly offered to accompany me to the spot. This we found to be a deep deposit of gold-gravel and whitish clay, at least 25 feet thick, that being the height to which we ascended it above the level of the stream.

As our party emerged from the bushes on one side of the field of action, we caught a glimpse of the loose ends of some half a dozen diapers, "streaming like meteors to the troubled air," as the sable damsels who wore them, startled by our approach, suddenly dashed into cover on the opposite side.

The old man, however, after much persuasion, and an assurance from our patron, that we (the Doctor and myself,) intended him no harm, took up one of the wooden bowls, and filling it with the gravel, washed it hastily and presented the result for our inspection. In doing so, he trembled to such a degree that I thought he would let the bowl drop. He evidently mistook us for government spies, or some other obnoxious officials; and to my question as to how much gold a person could collect in a day, he replied in a deprecating tone, not more than one or two dollars.

Convinced, from the sample he had shown, that this was entirely under the mark, and wishing to obtain some rude data for estimating the richness of the deposit at this distance from its place of origin, I offered him two dollars if he would wash for me for a quarter of an hour. He declined, however, in the most positive manner. We afterwards witnessed the same repugnance in other localities; and on several occasions should have failed in our endeavors to purchase specimens, but for the timely intercession of our patron and bogas.

About four miles above the San Juan, we passed the Rock of the Virgin

of the Surúcco. This is a vertical face of tough gray sand-stone, about 25 feet high, on the north bank of the stream. It is dedicated to the Virgin; and in a rudely dressed little niche, half-way up it, burning candles are frequently deposited to her honor, and to propitiate her protection during the navigation of the stream. Three were burning in it as we passed; and as our men expressed a desire to stop a few minutes from motives of respect to the sanctity of the spot, we permitted them to do so; and at the same time we ascertained the strike of the strata to be about N. 30° E., with a nearly vertical dip.

We reached the San Juan at 3 o'clock, P. M., having expended four hours in actual boating, at the rate of about three and a half miles per hour. This gives 14 miles, measured along the sinuosities of the stream; or, as we judged at the time, about 8 miles in a direct line from the eastern foot of the dividing ridge to the San Juan; or 11 miles from where we left the Pepé. Throughout the greater part of its course, the lands adjacent to the stream are flat and wet; especially for some few miles before reaching the San Juan, where they are perfect marsh.

We found the mouth of the Surúcco to be about two and a half leagues below the town of San Pablo. On account of the current, and some bad rapids which occur in this interval, we required three hours of hard poling to traverse it; still, we arrived at the town, as our friend at the Pepé had predicted, a little while before the afternoon rain commenced.

Regarding this outline of our detour by way of the Pató, Baudó, and Surúcco, as an episode in the narrative of the main route from ocean to ocean, by way of the Atrato and San Juan, I will terminate it at this point; and recommence at Quibdó, at which place we had diverged from our prescribed path.

We returned to Quibdó by way of the Santa Mónica, the San Pablo, and the Quito, which under these names form the main westerly branch of the Atrato. (See Map, Plate XII.)

Throughout our absence of seventeen days, we had, with but very few exceptions, escaped the annoyance of heavy rains *during the day;* but as we approached within two or three miles of Quibdó, at 3 o'clock, P. M., it seemed as if the old town was determined to reassert, at once, its supremacy in the matter of water privileges; for the rain actually appeared for a while to descend in a solid mass, completely shutting out the river banks from our sight; and causing us a good deal of trouble to keep our boat afloat by bailing.

I suspect that the pre-eminence which we accorded to Quibdó over the adjacent region, in the rain line, is not owing to a casual excess during our stay; but more probably to its position at the confluence of three considerable streams, which, in the aggregate, expose a large superficies of water to the action of the atmosphere. I have frequently had occasion to remark, in tropical regions, that the prevalence of rain in particular localities, is very sensibly affected by the presence of sheets of water, even when of quite restricted dimensions. I may instance, for example, a lagoon some ten or twelve leagues inland from Carthagena, New Granada, in which I once spent several consecutive months *of a dry season*, on board of a dredging-machine. During this period, we had more or less rain, sometimes very violent, and frequently attended with much thunder

and lightning, for three or four days in every week; while, at the distance of but 6 or 8 miles from us, in dry localities, not a drop of rain fell throughout the entire interval.

On another occasion, I was stationed for some months about midway between two small lagoons eight miles apart. Here, during the dry season, three or four morning rains would fall over one of the lagoons, and three or four afternoon ones over the other, almost every week; while the midway station would receive but one or two light showers, generally of but a few minutes duration, in the same time.

The constant humidity of the air, at Quibdó especially, is a source of many annoyances. The store-keepers experience much difficulty in protecting their dry goods from its injurious effects; and frequently sustain losses from mould, and from the running together or fading of the colors of many of their fabrics.

Many articles of groceries likewise deteriorate rapidly under its influence. Your table salt is semi-fluid; and spices generally, after being a short time on hand, might almost be mistaken for ingenious imitations in white pine, as they nearly lose all flavor.

The clothes in our trunks were constantly damp and mouldy, although we spread them out in the sun whenever an opportunity presented itself. Satin and velvet appeared to be soonest injured. Also, any article of leather or morocco, such as boots, dressing and instrument cases, &c., contracted mould with great rapidity; and had to be overhauled and cleaned every day or two. Even the strongly scented Russia leather with which I had taken the precaution to have my note-books bound, suffered much from this source, although kept in a close box, and well wrapped in paper.

Had not Mr. McCann attended carefully to the airing of the effects left behind by Dr. Halsted and myself during our absence, I suspect that most of them would have been ruined.

The blue-lines of our ruled paper soon became nearly obliterated, although the red ones did not appear to be affected. The rust had to be cleaned from the steel portions of my drawing instruments whenever I used them; and many minor articles, "warranted to keep in any climate," such as soft water-colors, Seidlitz powders, water-proof lucifer matches, &c., soon became nearly worthless.

I should certainly recommend a portable sheet-iron stove as a very essential contribution to not only the comfort, but the health, of any person who may be doomed hereafter to undergo a sojourn of even a few weeks at Quibdó. Its use would, of course, be confined chiefly to the drying of wearing apparel and bed clothes.

With the exception of light chills and fevers, the climate was represented to us as by no means very prejudicial to the health of the natives; and we certainly saw nothing to suggest doubts of the assertion; neither did any of our party (all, however, previously well acclimated,) experience any sickness. But of some few foreign travelers coming from the interior, whom we encountered here, all were prostrated by fever. It is true, that in their cases, the sickness was probably induced or aggravated in a great measure by the privations and fatigue necessarily attendant

on traveling across this country; still, I cannot conceive that this region can be other than prejudicial to the general health of those who, having previously lived on dry land, suddenly find themselves compelled to assume an amphibious nature and habits.

A great number of the lower classes are, it is true, affected by cutaneous eruptions covering their whole bodies, and probably incident upon their constant exposure to wet; but I did not perceive that they suffered pain, or even inconvenience therefrom. We could not, however, fail to observe a prevalence of mild chills and fevers, among this class especially.

On arriving a second time at Quibdó, I immediately sat about making arrangements for reascending the river to San Pablo, and from thence prosecuting my exploration of the San Juan.

Our patron, Pedro Rociles, had so strongly recommended himself to us by his untiring industry, fidelity, and acquiescence to all our wishes, that I at once re-secured his services, and commissioned him to engage a boat and bogas; or more properly, peones, as the term bogas applies more strictly to those who manage the large trading boats from Carthagena.

The understanding was, that all should be ready within three days; but, as usual, one difficulty after another presented itself, detaining us in Quibdó for twelve days.

Time hung heavily on our hands during the interval; for, as the successive procrastinations were but for a day or two, we could not devote them to boating excursions of sufficient extent to be of service; and, as to pedestrianism, there is no ground to walk on.

During one of our delays, however, Dr. Halsted distinguished himself by a skilful amputation of an arm of a poor boga, who was accidentally shot in sport, by one of his comrades.

We also experimented, unsuccessfully, on various animals, with the Indian poison. As an apology for its inefficiency, I should, however, state that they are said to employ a more deadly kind when *men* are the game pursued. They use both kinds, not only on the long arrows of their bows, but on the short ones of their bodoqueras, or blow-guns, in the use of which they are very expert.

These blow-guns are made by tieing together two strips of palm, some three or four yards long; in each of which a semi-circular groove, about an inch in diameter, has been previously hollowed out with great care.

At this period, too, Father Ochóa, (nothing abashed by the inauspicious result of his communications respecting the height of the ridge between the Pató and the Baudó,) endeavored to prevail on me to take him with me to explore the routes by way of the Arquia and Cacaríca lagoons, near the mouth of the Atrato. The only pre-requisite insisted on was, that I should provide him with a few hundred bright gold dollar pieces, for propitiating the favor of the wild Cunos Indians who inhabit the interior mountains of that region; and over whom he assured me he could exercise unlimited control.

On this condition, he guaranteed to carry me from the Atrato to the beach of the Pacific, within the time that I could smoke a single segar.

There is a magnificent route for you, gentle reader; and a brilliant chance for distinction, for some future explorer.

Many speculations have been urged upon the public respecting these routes, as well as those by way of the Napipi, and the San Juan. I imagine that they have their origin in the following circumstance: the mountains to the west of the mouth of the Cacaríca, suddenly deviate from their north and south trend, and, making a great bend to the southwest, stretch over towards the Pacific; leaving an immense expanse of marsh between themselves and the Atrato. (See Map.)

Spread over this marshy tract, are interspersed many lagoons of considerable area. These are drained into the Atrato by several caños which enter that river at points comprised between the Tequerré on the south, and the Arquia on the north. The last is not shown on my map, inasmuch as I did not see it, probably from its entrance being hidden by the long grammalote grass. It enters the Atrato not many leagues above the mouth of that river.

Now, to a person looking westward from any point on the Atrato, south of the Cacaríca, the mountains appear to become lower, and finally to subside altogether, as they approach the Pacific. There are not, however, the slightest grounds for imputing this effect to any other cause than the optical illusion which invariably attends all such cases; and the assumption of it as proof of a depression in the mountains, is at least untenable.

I certainly could not perceive, from either the Atrato or the Pacific, the most faint direct indication of the existence of any such depression.

The Indians of the mountains, and of the Pacific shore, do certainly visit the Atrato with their canoes, passing through all the ca os above mentioned. No one, however, could inform me, *positively*, whether they employed different sets of canoes on the opposite sides of the isthmus; or whether they dragged them across the intervening ridge. Even the latter case would constitute no argument whatever, against the existence of a continuous mountain range; inasmuch as the transportation of their canoes across mountains is not here regarded as at all an onerous task.

I do not, however, doubt that the mountains can be much more readily crossed almost any where along this great bend in their course, than at any point more to the north; and there is every reason to suppose that the Indians have here atravesias, or crossing-places of comparatively easy transit.

A perfect level depression *may* exist, but there is no reason to suspect it.

At the end of the first stipulated three days, Pedro called to inform us that his wife was sick, and probably would not recover for at least two days more; and, of course, that respite was allowed. When it had expired, he again visited us with the announcement that his children had been attacked with the chills and fever. In consideration of this fresh affliction, we postponed our departure for two days more. But when they had passed, the family had not recovered sufficiently to justify Pedro in leaving them to their own resources on the banks of the Munguidó, where attentive neighbors were not only few and far between, but endued withal with that peculiar temperament which would have derived much more gratification from guzzling guarapo over the mortal remains of his pro-

geny, during the absence of their honored sire, than from presenting them to him in restored health on his return.

His own inventive faculties, however, suggested a resource in this dilemma. He had a bosom friend, who, in consideration of three reales (about 30 cents) a-day, would remain with his wife during our trip, and show her every attention that she could receive from himself. As I considered this very cheap, in view of the arduous services that the lady would probably exact, I sent Pedro forth to inform his substitute that I would cheerfully contribute the three reales per day.

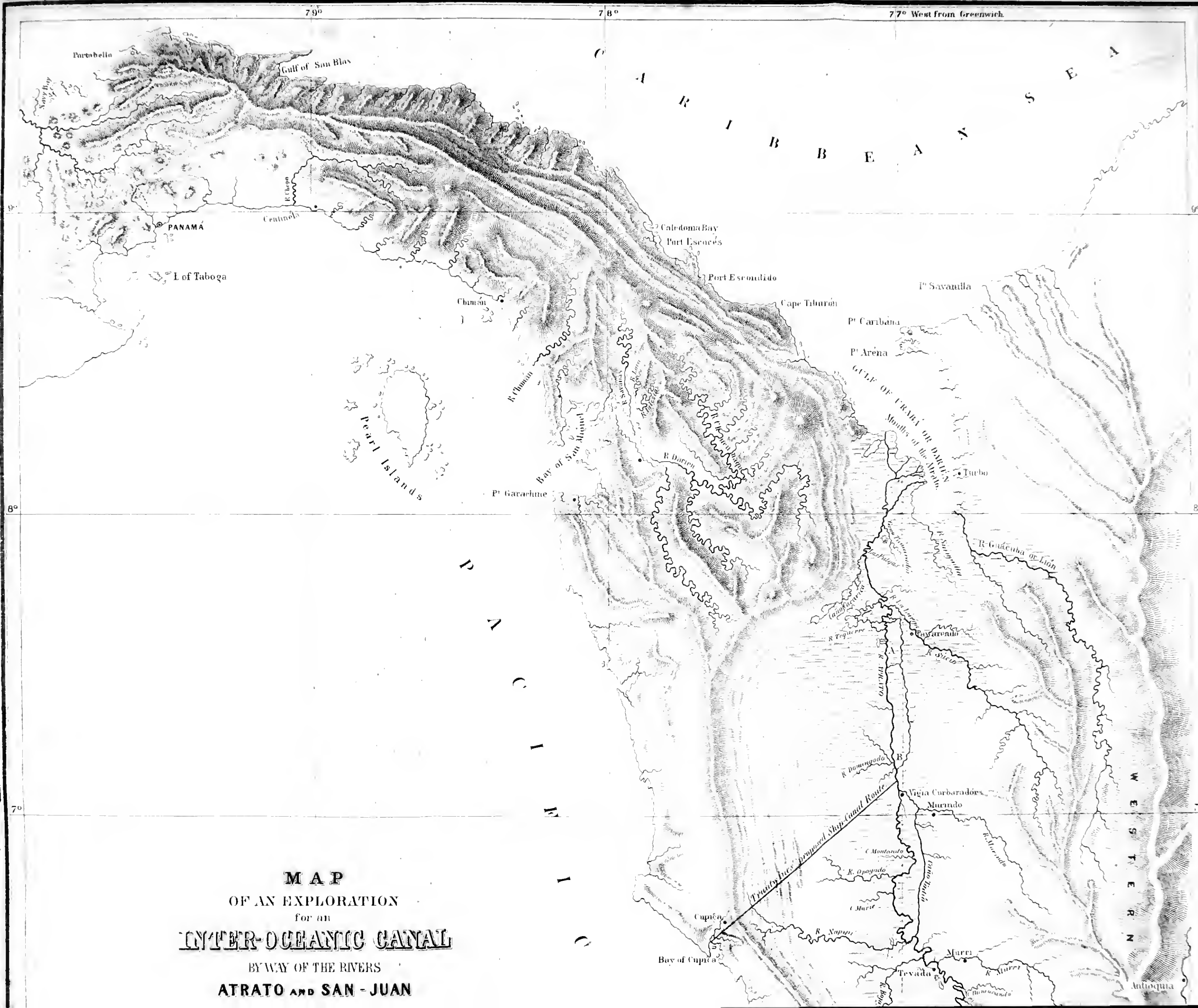
But, in consequence of the immense extent of Quibdó, or perhaps from having sunk in a marsh, or being lost in a fog, or some other equally credible reason, he did not find his way back to our house until next day. He had, however, had an interview with his friend during the interval; and had ascertained that the undying affection of his Pythias was some 70 per cent. more valuable than he had estimated it at, and was not to be hired out under five reales per day; the two additional ones being (theoretically) to be applied to the payment of his meals while sojourning at his friend's house.

Being very impatient to start, I, of course, did not demur at the strike; but at once despatched Pedro with the most strict injunctions, to have every thing ready for our departure by sunrise on the next morning. Possibly, I did not express myself in very good Spanish ; for instead of next morning, he came the next evening; and instead of having every thing ready, he had nothing ready. He had however just now recollected, that the boat had no toldo; and as to-morrow was Saturday, it would be utterly impossible, save by superhuman energy, to complete one in time for Monday, inasmuch as the peones whom he had engaged were pious men, and could not be induced to work at it on the Sabbath. But fortunately they had authorized him to state, that if I would allow them double pay for Saturday, they would put forth the superhuman effort required, and by doing two days' work in one, would be ready by sunrise on Monday.

I at once advanced the extra pay; but on receipt thereof, the religious zeal of the peones waxed faint. They indulged in a spree on Saturday; but atoned for it by working at the toldo, like Trojans, on Sunday ; and brought the boat to our landing on Sunday evening.

Having experienced much inconvenience from the want of height in our other toldo, which did not admit of our sitting upright under it, we had especially enjoined upon Pedro the necessity of making this one about four inches higher, and had given him a twig four inches long as a guide. We found, however, that it was precisely the same as the other; and on censuring him for the oversight, he referred us to the peones, who had constructed it, and to whom he had communicated our orders. They assured us that they could not do otherwise than they had, inasmuch as the present height was in conformity with the "costumbre del pais." This is an argument that admits of no rejoinder, and we had to be content accordingly.

The boat was no larger than the one we had used before, and as in view of our longer intended absence this time, we were burdened with more baggage, it again became necessary to leave Mr. McCann behind.

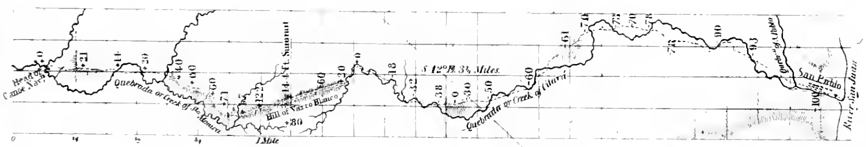

79°
78°
77° West from Greenwich
CARIBBEAN SEA
PACIFIC
WESTERN
Portobello
Gulf of San Blas
PANAMA
Centinela
I. of Taboga
Chimán
Pearl Islands
Bay of San Miguel
Pt Garachine
Caledonia Bay
Port Escocés
Port Escondido
Cape Tiburón
Pt Savanilla
Pt Caribana
Pt Arena
GULF OF URABA OR DARIEN
Mouths of the Atrato
Turbo
R. Darien
R. Guacuba or Lion
Pavarando
R. Sucio
R. Atrato
R. Domingodo
Vigia Curbaradór
Murindo
Truando Ship-Canal Route
Cupica
Bay of Cupica
R. Napipi
Murri
Tevada
Antioquia
8°
7°
MAP
OF AN EXPLORATION
for an
INTER-OCEANIC CANAL
BY WAY OF THE RIVERS
ATRATO AND SAN-JUAN

OF AN EXPLORATION
for an
INTER-OCEANIC CANAL
BY WAY OF THE RIVERS
ATRATO AND SAN-JUAN
IN NEW GRANADA, S.A.
Laid down from observations made by
JOHN C. TRAUTWINE, CIV.-ENG.
IN 1852

NOTE.

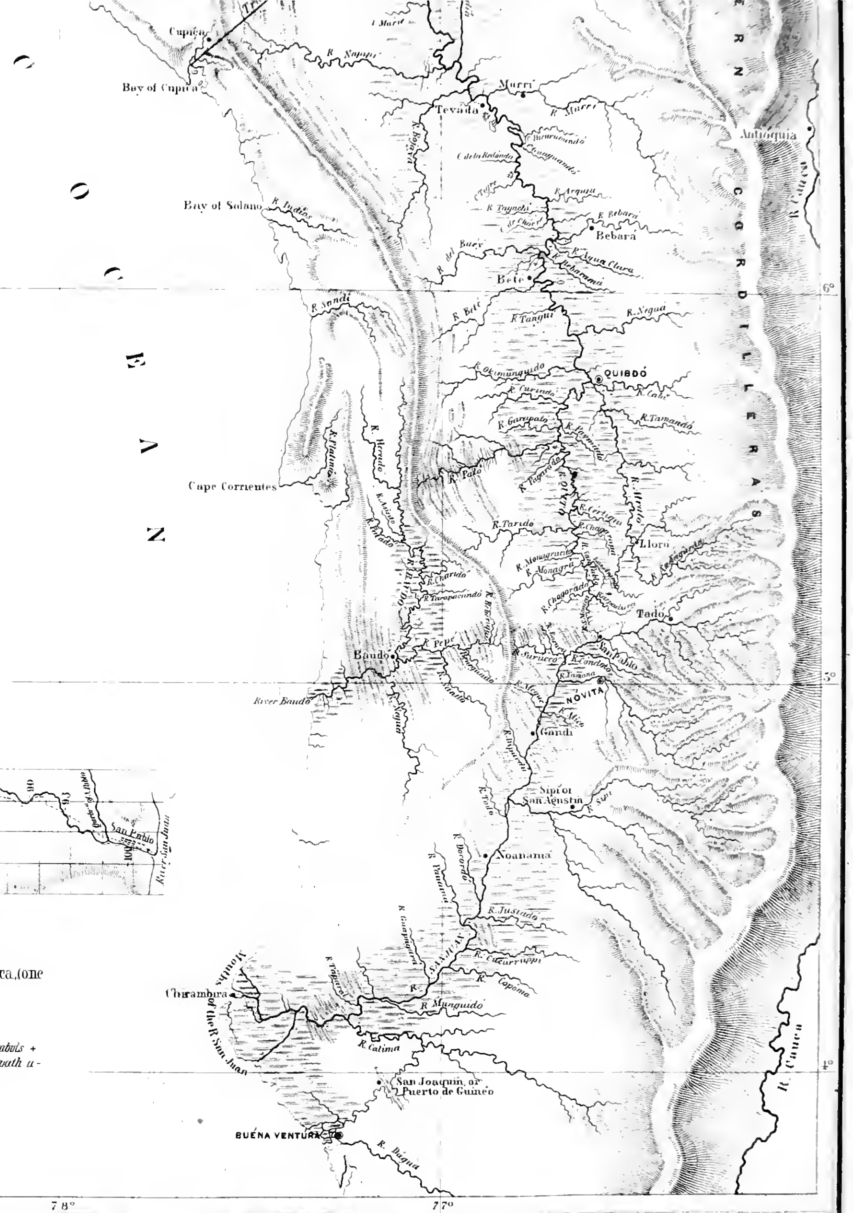
The following portions have been protracted from my notes, viz.
The Atrato from its mouth, up to the confluence of the Raspadára and Santa Monica, (near its head), except from A to B
Also the River Baudó, from the confluence of the Heradó, to the Ocean
Also that portion of the River San Juan which lies between Chirambirá and the River Mungaidó.
I merely observed the distances (not the bearings) of the Pató, the Pepé, the Surúco, and the San Juan from San Pablo to the Munguidó
The protracted portions exhibit all the bends in the respective streams.
The red lines ——— show my route
In filling-in the mountains on the Isthmus of Panamá I have merely aimed at exhibiting the General character of the interior as suggested by the appearance from both sides. The height of the principal range appeared to vary between ½ and ¾ of a mile
The blue line ——— shows the route proposed by myself for a Ship Canal, as preferable to any other, theoretically, but impracticable on account of its cost, which I estimate roughly at $325,000,000

J. C. T.



ROUTE OF THE LINE OF LEVELS
run across the dividing ground between the head of Canoe navigation on the Santa Monica, (one of the head waters of the Atrato,) and the River San Juan at San Pablo.

The Starting point, or Zero of the levels is at the head of Canoe navigation on the Santa Monica, and the Symbols + and − denote the elevations or depressions above or below that point in feet. The dotted line shows the Indian path across which the levels were run



P. S. Duval & Cos Steam lith Press Phila

His detention, however, was attended by the satisfaction that we thereby secured a more extended series of observations on the river, inasmuch as he kept a regular table of its fluctuations.

Although Dr. Halsted and myself were in readiness by daylight, yet our peones contrived to delay our departure until near noon. They had put off their purchases of provisions until now, on the plea that perhaps we might, after all, change our minds and not go.

We had every reason to believe that the unexpected shuffling conduct of Pedro had been dictated (on the principle of sharing the spoils,) by one of our best apparent friends, whose station should, in the most special manner, have shielded him from any such imputation.

It is even probable that we should have been subjected to still further delay, had it not been for the interference of the Governor, and Dr. Key.

When we descended the river twelve days before, we saw it in a stage of high flood; but now as we commenced our ascent of it, at noon of August 17th, it was at rather a low one, giving but eight feet in mid-channel at Quibdó.

It will be remembered that I now refer to the Western branch of the River, which at Quibdó, takes the name of Quíto; that of Atrato being retained by the Eastern branch.

I have before stated, that the *ordinary* stages of the Atrato at Quibdó may be regarded as fluctuating between ten and sixteen feet in mid-channel; and that there are probably not more than thirty days in the year, (of irregular recurrence,) when it affords less than seven feet in the deepest part of its cross-section at that place; although liable, for a few days every year, to become reduced to but scant three feet, which may also be regarded as the least extreme low water channel depth at any point below the town; but of course occurs at more frequent intervals above it.

The Quíto, from Quibdó, to the Pató. While the river was in this low stage of but eight feet maximum depth at Quibdó, we found that seven feet could be carried up the Quíto all the way to the mouth of the Pató, or seventeen miles. By far the longer portion of the distance indeed, gave us greater depths, as we nearly every where could pick out a channel with from eight to ten feet, thus proving that at ordinary times the Quíto would thus far afford at least ten or twelve feet.

When the stream was in high flood, at the time of our descent, some two weeks before, we had found as much as 18 feet, not only from the Pató to Quibdó, but above the Pató as far as the junction of the Certigui and San Pablo, or 32 miles above Quibdó. At that time, the current was about three miles per hour in mid-channel at both the Pató and the San Pablo, and, indeed, up to the head. It must however be borne in mind, that as we ascend, the channel becomes much narrower, as well as more circuitous, and encumbered with bars; and would consequently require skilful pilots to navigate it with security. In many places we found the eight or nine feet channel depth, to be confined within a width of from 75 to 100 feet; and with a shifting bed.

The width of the stream varies a good deal; but for some miles below the Pató it may generally be regarded as from 100 to 150 yards. At the Loma de los Palacios, or Hill of the Palaces, (a gravel bank about

half a league below the Pató,) it is contracted to 70 yards; and at one spot just below the Paymado, it was but 100 feet when we ascended.

The descent of the Quíto, taken with the spirit-level at a point about three miles below the Pató, was at the rate of 20 inches per mile.

At the time of this visit, the bar at the mouth of the Pató was bare; and some twenty black women and children were washing fine gold dust from the gravel thus exposed.

We had also seen a party similarly engaged, with their calabashes and wooden bowls, on a bar some two leagues above Quibdó. In this immediate vicinity, they can only work to advantage when a low condition of the water exposes shoal places in the bed of the river. In other positions, the marsh mud, and other alluvial deposits, have buried the wide spread auriferous diluvium beyond their reach, except in certain spots where it shows itself in elevated bluffs along the river. But, until we ascend to near the sources of the streams, where the water is at nearly all times shallow, these bluffs almost universally form the steep sides of sudden bends, and descend precipitously into too great a depth of water to admit of being worked by the primitive means at the disposal of these people. I believe I have before stated, that gold is obtained in small quantities from the river gravel at Quibdó, whenever the water becomes sufficiently low for the purpose; and that the authorities had been compelled to forbid the digging of holes around the town, which is situated on a bluff, of gold-bearing gravel.

The entire bed of the Quíto, together with those of its eastern tributaries, and of all the streams between it and the Western Cordilleras, are throughout, rich in gold. It is not, however, until we approach to within a few leagues of the Cordilleras, that the particles assume a size larger than what is generally known as gold dust. I procured specimens from many localities far apart, and invariably found them to be accompanied by the black ferruginous sand; and, generally, by platina. In all cases, the gold was remarkably pure. Wherever bluffs of gravel show themselves along the river above Quibdó, they contain gold.

The Quíto, from the Pato to the confluence of the San Pablo and Certigui, a distance of 15 miles; or 32 miles above Quibdó.

Above the confluence of the Cértigui, the Quíto loses its name, and is called the San Pablo.

Its width here is but about one-half as great as at the Pató, being on an average but about 50 or 60 yards. Its bed, however, is depressed to nearly the same distance below the tops of the average levees at both points, namely, some 18 or 20 feet in mid channel. Consequently, inasmuch as the highest floods barely overtop these levees by some two feet, the greatest depth of channel-way in heavy freshets, is nearly uniform throughout the intermediate distance. But a greater *ordinary* channel depth than some seven feet, could not be safely calculated on, although by the removal of a single short gravel bar about a mile below the confluence, this might be increased to nine feet; or nearly as great as that assumed up to the Pató; and with nearly as great a width, or from 60 to 80 feet. Ordinary depths of from 10 to 14 feet, however, are by no means of unfrequent occurrence up to here, the bed being quite irregular.

We had carefully observed the bends of the stream, and judged that at ordinary stages, a steamboat 150 feet long could pass around all that we had seen up to this point.

Our spirit-level, here indicated a fall of about $2\frac{1}{2}$ feet to a mile.

Thus it appears that, were it not for the incessant fluctuations of this stream, which, within a few hours, frequently reduce it from its *ordinary* ample channel depth, to one of but 5 or 6 feet, and sometimes of but 3 or 4 feet, the Quíto would present a magnificent steamboat thoroughfare to this point, which is, by my computation, 252 miles above the Gulf of Urabá, at Boca Coquíto.

But at these low stages, which recur at periods altogether irregular, the width, as well as the depth, of channel-way becomes very much reduced; converting the Quíto, indeed, into a mere respectable brook, barely sufficing for the larger ranchadas of the country. Moreover, the fluctuations in this branch of the Atrato are subject to much more frequent changes than the portion below Quibdó; the latter being maintained in a *comparatively* equable regimen by the more constant and copious rains which fall on the Western slope of the Cordilleras.

The shifting of the bars, and the number of sunken trees, which increases as we ascend, tend still further to embarrass the navigation at low stages of water. Great numbers of these trees would have to be removed, were steamboats, even of small size, to be introduced. Above the Certigui, the bed of the stream may be said, without exaggeration, to be literally covered with them.

(To be Continued.)

Translated for the Journal of the Franklin Institute.

New Instrument for Rapid Surveying.

M. Porro, certainly the most indefatigable inventor among civil engineers, has just submitted to the inspection of the Academy of Sciences at Paris, some new instruments, "for rapid surveying, with general and simultaneous leveling, and reference by rectangular co-ordinates to the meridian, and level of the sea." "These instruments permit the determination, by a single observation at a single station of the three polar co-ordinates of a point in space, and the transformation of these, without what is properly called calculation, into the rectangular co-ordinates, the time necessary for this does not exceed two minutes for each point. The degree of accuracy obtainable, is $\frac{1}{500}$th for the smaller, and from one-thousandth, to the quarter of one-thousandth for the other."

These instruments are said to be summarily described in the *Annales des Ponts et Chaussées*, but we regret that M. Porro, in view of their great importance (if true,) has not described them minutely in some more accessible publication. The method in which he speaks of them in his communication to the Academy, does not convey to a foreigner any very clear ideas of their theory or construction, as may be judged of by the following extract: "The optical part of this apparatus consists in splitting the *anallatizing* glass of any *diastimometric* telescopes, &c." When we recovered from this description, which requires for its comprehension much more knowledge than we lay claim too, we found a remembrance

germinated in our minds, (like a crystal in a saturated solution after an electric discharge,) of the instrument of M. Villeroi, described in this *Journal*, (Vol. XVIII, p. 238, Third Series). In this the object glass was divided, and in consequence the distance of a point could be determined by using a double target, of which one was sliding. But whether this glass was *anallatizing*, or whether the telescope was *diastimometric*, that is what we cannot say.

By the way, we remember, that about the time that M. Villeroi exhibited his plan to the Franklin Institute, Mr. G. Escol Sellers communicated to us, confidentially, a plan which appeared to us much better, for accomplishing the same end, that is, the determination of distances by a single observation and without chaining. What has become of it ?—Ed.

AMERICAN PATENTS.

List of American Patents which issued from June 20th, to July 11th, 1854, (inclusive,) with Exemplifications by Charles M. Keller, *late Chief Examiner of Patents in the U. S. Patent Office.*

JUNE 20.

124. For an *Improved Tool Handle;* George W. Griswold, Carbondale, Pennsylvania.

Claim.—"I claim so combining a double acting pawl and star-shaped ratchet with the stock and handle of a screw driver or gimlet, as that by pressing the thumb or finger on one arm of the pawl, and turning the handle, the screw may be driven into the wood, and by shifting the thumb or finger on the other arm of the pawl, and continuing to turn the handle in the same direction, the screw or gimlet shall be drawn out of the wood, substantially as described."

125. For an *Improvement in Producing Continuous Circular from Reciprocating Rectilinear Motion;* Charles S. Harris, Holyoke, Massachusetts.

Claim.—"I do not claim a rack and pinion, or the duplication of the same, or a combination of two racks and pinions, or two racks and semi-pinion, so applied as to produce circular motion from a rectilinear motion; nor the combination of a bow and string or band with a pulley for obtaining a circular motion from a rectilinear motion, nor the mere duplication of such devices; but what I do claim is, the so combining with the bow or bar and the two bands and the handle, or its equivalent, a vibratory or rocker lever, that during the reciprocating rectilinear movements of the bow or bar, caused by the power applied to such rocker lever, it shall be made to operate so as to alternately tighten and loosen each cord upon the pulleys of the drill stock, as specified, and so to cause the drill stock to be rotated."

126. For an *Improvement in Cast Iron Car Wheels;* John Henry, Lynchburgh, Va.

Claim.—"I do not claim a central plate running from the hub to the rim, and not connected with the inner and outer plates, as such a wheel was patented by Fred. Warback, November 6th, 1847; but what I do claim is, the intermediate continuous plate, extending diagonally from the hub to the rim, (in a cast iron wheel having double plates or disks,) and connecting the two plates of the wheel together, substantially as described."

127. For *Extra Yard to Topsails;* Frederick Howes, Yarmouth, Massachusetts.

Claim.—"I claim the application of an extra yard, supported by truss, crane, or brace, as described, or any other substantially the same, and which will produce the same effect."

128. For an *Improvement in Carriage Tops;* Solomon F. Huntington, Syracuse, N. Y.

Claim.—"I claim the method of supporting the top by means of an inverted bow inside the covering of the top, and attached to or standing upon the back of the seat, and

having its ends firmly attached to the back bow of the top, or any other analogous device effecting the same object. In connexion with this, I claim the method of dropping the top by detaching this bow from the back of the seat, and supporting it in proper position when dropped, by flexible or elastic stays. Also, the extension of the jointed brace forward of the front bow in such a manner as to form a handle or lever within reach of a person in the carriage, and by which the brace may be worked, substantially as described."

129. For an *Improvement in the Mode of Moulding Bricks;* Nathan Johnson, Noblesville, Indiana.

Claim.—"I claim the mode of at once distributing the mortar, filling the moulds, and removing the surplus material, viz: by means of the lute, applied as described. I claim further, that with them bricks can be made without the assistance of off-bearers, and at one-fourth less expense than they can be made in any other way."

130. For an *Improvement in Gas Metres and Regulators;* Charles C. Lloyd, Philadelphia, Pennsylvania.

Claim.—"I claim the application of the principle or mode of operation herein described, whereby the double purpose is effected of equalizing or regulating the pressure of the gas within the metre, and of shutting off the gas when the water gets too low, by combining the valves with one and the same float, all within the metre, substantially as described."

131. For an *Improvement in Painters' Brushes;* John S. Martin, Boston, Mass.

"The nature of my invention consists in providing the bristles of the brush with an elastic binder, to extend from their connexion with the handle and around the pack, and down toward the point or working end of the brush."

Claim.—"I claim the application of an elastic binder to a brush, instead of an inelastic cord or binder, as commonly used, the said elastic binder being composed of caoutchouc, or other suitable material or materials."

132. For an *Improvement in Radial Arms for Car Brakes;* Thomas G. McLaughlin, Philadelphia, Pennsylvania.

Claim.—"I am aware that a radial arm, turning loosely on the brake lever shaft of the tender, and raised to a horizontal position by a spring and lever, in connexion with the means of operating the brakes of the tender to which it was attached, has been patented; therefore, I do not claim the means for raising the radial arms, as herein described; but I do claim the employment of the radial arms, in combination with the catches or lips formed on the radial arms, for the purpose of relieving the horizontal shaft on which the radial arms are firmly secured, of the pressure or force which may be exerted against the ends of the radial arms, when operating the brakes of the several cars in a train, by the means that have been heretofore invented by me for that purpose."

133. For an *Improved Burglars' Alarm;* Duncan E. McDonald, Springfield, Mass.

Claim.—"The arrangement of the clamp, brace, guard, and plate, for securing doors and windows being already patented by me, May 31, 1853, I do not, therefore, claim the said device of the clamp, brace, guard, and plate, for the above purpose; but what I do claim is, the clamp, brace and guard, and plate, in combination with the hammer, the spring, and dog; the above parts being constructed and arranged in the manner set forth."

134. For an *Improvement in Steam Engine Regulators;* Anson Merriman, Middletown, Connecticut.

"The nature of my invention consists in an apparatus for regulating the flow of steam to the steam cylinder, and thereby to determine the velocity of the engine according to the work it is to perform."

Claim.—"I claim the chamber, cock and safety valve, holding a portion of steam in store, and in combination with the pump drawing from and returning it to the same source, and acting on the piston during the dead points of the engine. 2d, The aperture, chamber, and safety valve, so weighted as to hold the steam at greater pressure than in the boiler, in combination with the pump or pumps for forcing the steam into the said chamber for forming a magazine to feed the cylinder at the moment the engine is passing the dead points, and operating in the manner described."

135. For an *Improved Watch Chain Swivel;* Nathan F. Mathewson, Providence, R. I.

Claim.—"I claim constructing the spring inclosing slide with the smaller or opening section of the loop fast to it, and gearing the said slide by square or angular recess in it, and corresponding shaped shoulder on the shank, with the main section of the loop for operation together, in the manner specified, whereby the hook is opened and closed with greater facility, and the opening section firmly held in its open position without applying the finger or hand thereto, and without destroying the loop form of the hook, and without employing a cross swivel joint in the loop, as described."

136. For an *Improved Slate Frame;* Edmund Morris, Burlington, New Jersey.

Claim.—"I claim constructing a slate frame of corresponding halves, of such a shape that a single joint combines them with each other, at the same time that it firmly secures the slate between them."

137. For an *Improvement in Breast Pump;* Oswell H. Needham, City of New York.

Claim.—"I claim the combination of an air pump, operating with a nipple shield or cupping shield, made of flexible material, substantially in the manner set forth, by means of a flexible tube, so that the motion of the working of the pump will not be felt upon the parts operated upon, so that the patient can operate it herself, and regulate the action in a manner never before effected."

138. For an *Improved Method of Turning Casks, &c., from Solid Pieces;* James P. Osborn, Staunton, New Jersey.

Claim.—"I do not claim the making of the bodies of barrels, casks, tubs, &c., by turning them in one piece out of the solid block; but I claim, 1st, The tool bearers, cutting in contrary directions, in combination with the cross heads, in the manner described. 2d, The combination of the cross heads with the connecting rods and feed screws, in the manner as described; and, 3d, The method, substantially as described, of adjusting the position of the tool bearers."

139. For an *Improvement in Cast Iron Vises;* Chas. Parker, Meriden, Connecticut.

Claim.—"I claim casting the movable jaw or chap of a vise so as to inclose and secure by the operation, one or more wrought iron bars within the tail or guide rod, at or near the point of greatest strain; said bars being enlarged or bent at the ends, the better to secure the same to the casting, in order to act as a chord or chords to resist tensile strain, and thereby secure the maximum of strength with the minimum of metal, as described."

140. For an *Improvement in Railroad Car Brakes;* Benjamin F. Reimer, Philadelphia, Pennsylvania.

Claim.—"I claim the brake, consisting of a perpendicular rod, the guides, the rollers, the chain, and the mode of attachment, the whole being arranged substantially as described, for the purpose of operating either by the mechanism for acting simultaneously upon all the brakes in the train, or independent of the same by the lever."

141. For an *Improved Arrangement of Ships' Capstan and Windlass;* Jesse Reed, Marshfield, Massachusetts.

Claim.—"I claim the arrangement of the movable capstan with the two windlasses, constructed and operating in the manner set forth, so that either windlass may be turned in either direction, by operating upon the single capstan."

142. For a *Machine for Drying Grain;* S. Brockway Robinson, Oswego, New York.

Claim—"I claim a trough or cylinder with a perforated bottom, provided with a conveyor or stirrer, in combination with a blast of heated air, forced through the perforated bottom."

143. For an *Improvement in Tentering Cloth;* Warren Shaw and Parley G. Green, Wales, Massachusetts.

Claim.—"We claim the adjustable obliquely situated tenter wheels, provided with laterally playing tenter points, in combination with the oscillating guides, arranged and operating in such a manner as to seize the cloth and stretch it uniformly, at the same time bringing its edges perfectly even and straight, in which condition it is delivered to the tenter points of the drying apparatus, to be retained thus till dried and received by the folding apparatus."

144. For an *Improvement in Gas Retorts;* Adrian R. Terry, Detroit, Michigan.

Claim.—"I claim the application to gas retorts of a coating which consists of a series of layers or laminæ of luting and metallic wrapping, substantially as specified."

145. For *Application of Ordinary and Superheated Steam Combined for Heating Purposes;* Chas. E. Wethered, John Wethered, and Sam. Wethered, Baltimore, Maryland.

Claim.—"We claim the application of the combination of ordinary steam and superheated steam, (which combination is effected by bringing them together in pipes of any convenient form, before or at the point where their contents are discharged,) for the purpose of boiling, evaporating, drying, melting, and heating."

146. For an *Improved Mode of Raising and letting Fall Carriage Tops;* Jos. R. Winchester, Medina, New York.

Claim.—"I claim the cross brace attached to the outside braces and the centre part of the outside braces, performing, as it does, the office of a double brace, and the two attached to a carriage top or cover, in connexion with the other portions of the outside braces, will produce the desired effect."

147. For an *Improvement in Folding and Measuring Cloth;* William C. Wright, Boston, Massachusetts.

Claim.—"I claim, 1st, Making the folding table of a machine for folding and measuring cloth, to move with a reciprocating motion, so as to make the folds and determine their length, and also the making said motion adjustable, in order to change the length of the folds to be made and measured. 2d, The combination of the moving folding table, operating as specified, with the guiding folders and elongated holders to each side of the table, for folding and guiding the cloth to be folded, and holding it as set forth. 3d, Making the said holder adjustable upon the ends of the folding table, so as to accommodate different lengths of folds. 4th, Relieving the cloth when folded from the folders and holders, so that it may be removed from the folding table by raising all of them simultaneously by means of the treadle connected to the said folders and holders, through the mechanism above described."

148. For a *Mode of Setting and Holding Pens for Paper Ruling;* S. W. Collins, Charlestown, Mass., Assignor to W. O. Hickok, Harrisburg, Pennsylvania.

Claim.—"I claim the extension pens and adjusting beam constructed and combined in the manner set forth."

149. For an *Improvement in Machines for Cutting out Boot Soles;* Luther Hill, Stoneham, Assignor to Luther Hill and Lorenzo Stratton, Fentonville, Mass.

Claim.—"I do not claim the invention of a bed knife, nor the combination of a press platen, or follower therewith; nor the making the follower with its undue surface a plane surface for the purpose of stamping out soles from leather; but what I do claim is, combining with the under side of the follower and with the cutter, as described, a sole bender or former or projection in relief of the form necessary to bend the sole into the shape it is to have when fixed on a boot or shoe, the said sole former by bending the leather, causing its edges to stand perpendicularly to the plane of the outer edge of the upper surface of the concave side of the sole, as specified."

150. For an *Improvement in Omnibus Registers;* Levi W. Mallory, Assignor to Wm. Morris, Philadelphia, Pennsylvania.

Claim.—"I claim the combination of the rod, guide, lever, spring, coupling, and eccentric ratchet or trigger, operating substantially as set forth, to prevent the ringing of the bell until the fare is registered."

151. For an *Improvement in Padlocks;* Stephen White, Assignor to Henry C. Jones, Newark, New Jersey.

Claim.—"I do not claim simply notching one of the bolts to act as a stop for the reception of a tumbler or spring dog, or any equivalent, as this alone would not accomplish what my invention accomplishes. What I claim is, making the sliding bolt with a shoulder, or its equivalent, acting substantially as specified, in combination with the turning bolt, both entering the mortise of the shackel in opposite directions."

JUNE 27.

152. For an *Improvement in the Furnace of Steam Boilers;* Jonathan Amory and W. P. Parrott, Boston, Massachusetts.

Claim.—"We claim conducting off the carbonic acid gas, or other heavy and incombustible gases which check combustion, by means of a pipe which communicates with the bottom of the furnace, at or near one end of the same, and with the smoke pipe or flue, as described."

153. For an *Improvement in Cider Mills;* Jesse Bauman, Shepherdstown, Penna.

Claim.—"I claim the use of the wheel, provided with off-sets or planes, and teeth or spikes, as described, in combination with the springs, for grinding the fruit. 2d, The arrangement of the grinding wheel and springs with the cam, pressing box, and furnace drawer and spring, for the purpose of dressing the pulp and delivering the pomace. Lastly, I claim, in the secondary mill, the arrangement of the spring, concave, and cam shaped rasping wheel or grinder, for the purpose of reducing the fruit to a pulp."

154. For an *Improvement in Coffee Mills;* Chas. H. Beatty, Wheeling, Virginia.

"The nature of my invention or discovery consists in the construction of the crank or operating lever, which is made in two parts, parallel with each other."

Claim.—"I claim adjusting the movable grinder of coffee or spice mills, by a handle or lever composed of two parallel pieces and a tempering screw, substantially as described."

155. For an *Improved Grape Frame;* J. Oscar Cross, Kingsbury, New York.

Claim.—"I claim an adjustable elevating and depressing grape frame, with or without supporters attached, (made of any known material,) for the better cultivation of the grape, which is believed will secure all the advantages specified."

156. For an *Improvement in Gas and Liquid Regulators;* T. H. Dodge, Nashua, N. H.

Claim.—"I claim the employment for regulating the flow of gases and fluids of two chambers, having communications at top and bottom, and being partly filled with water or other liquid, and furnished with a valve and float, arranged and operating substantially as described."

157. For an *Improvement in Grass Harvesters;* George Esterly, Heart Prairie, Wis.

Claim.—"I do not claim the frame, nor the drivers' seat thereon, nor the tongue, nor the driving wheel, gearing, gearing shaft. nor the connecting rods, nor the shoe, nor the sickle beam, nor the sickle sill, nor the dividing finger, nor the lever; but what I claim is, 1st, The construction of the sickle in such manner as to have projections on alternate sections of the sickle sliding upon the bar, operating for the purposes set forth. 2d, I claim grinding off the raised or feather edge made by the chisel in cutting the sickle, as set forth. 3d, The attachment of plough to the sickle beam by a screw pivot to fit said plough to the surface of the soil, in the manner set forth."

158. For an *Improvement in Reversible Capstans;* Joel A. H. Ellis and Alexander Gordon, Rochester, New York.

Claim.—"We claim the shifting spur wheel connected to the shaft of the capstan by feathers, and operated by a lever, or its equivalent, for the purpose of reversing the direction of the barrel of the capstan, without reversing the direction of the sweeps, and giving said capstan an increased backward motion, substantially as described."

159. For an *Improvement in Breech Loading Fire Arms;* J. Darell Green, Cambridge, Massachusetts; patented in England, May 12, 1854.

Claim.—"I claim the self-adjusting thimble, constructed and operating in the manner substantially as described. 2d, The peculiar manner described, of locking the barrel to the breech, by means of the wedge formed ears and the hooks, in combination with the method described, of controlling the forward and revolving motion of the barrel by means of the cylinder, the sleeve, and the spindle, the whole being connected together by the key, in the manner set forth."

160. For an *Improvement in Bank Locks;* Wm. Hall, Boston, Massachusetts.

Claim.—"I do not claim inserting a key within a cavity in the lock, and raising it by direct pressure produced by a wedge, or other means, against the tumblers or against pins projecting therefrom, as this leaves the tumblers at all times exposed to be operated

upon by an instrument inserted at the key hole; but what I do claim is, the slotted sliders, which are allowed to arrange themselves upon the steps of the former to form the bits of the key, in combination with the pin, or its equivalent, when the tumblers are operated by turning the key, whereby the tumblers are rendered inaccessible to any instrument that may be inserted at the open key hole, and the latter is closed whenever the key is turned so as to bring the slides to bear upon the tumblers."

161. For an *Improved Seed Planter;* Daniel Hill, Bartonia, Indiana.

Claim.—"I claim the reversible directing board plane on one side, and furnished with converging slats or ridges on the reverse side, for the purpose of either drill or broad cast sowing."

162. For an *Improvement in Manufacturing Suspender Ends;* Julius Hotchkiss, Waterbury, Connecticut.

"The nature of my invention consists in attaching the straps to each end of the buckle, by a double connexion, whereby a self-adjusting action is obtained that adapts itself to the position of the body."

Claim.—"I claim the double attachment or connexion of the straps with the buckle, substantially as described."

163. For an *Improvement in Sewing Machines;* Walter Hunt, City of New York.

"Said improvement consists in the manner of feeding in of the cloth, and regulating the length of the stitch, solely by the vibrating motion of the needle."

Claim.—"I do not claim, broadly, in the sewing machine, the feeding of the material to be sewn by the needle; but what I do claim is, 1st, Sustaining both ends of the needle whilst moving the cloth to effect the feed, by means of an inclined guide made adjustable, and placed under or upon the shuttle side of the cloth, substantially as described. 2d, The rotary table top, in combination with the guides and ways underneath the same, all arranged and operating in the manner set forth."

164. For an *Improved Rotary Cultivator;* H. M. Johnson, Carlisle, Pennsylvania.

Claim.—"I do not claim disks or rotary colters, sharpened at their periphery, nor disks having transverse knives on their periphery; but what I claim is, a system of sharpened disks or rotary colters, a part of which are armed upon their periphery with knives projecting laterally; said knives being set obliquely to the radius of the disk, as described; the whole being combined and arranged in three several sets, so that the two sets armed with knives shall cut alternate sections of the soil."

165. For an *Improvement in Drying Cloth;* D. W. Kennedy, Staunton, Virginia.

Claim—"I do not claim the revolving reel or heads having the cloth to be dried wound spirally between the heads, with a continuous air space between the revolutions; nor do I claim, in itself, for drying cloth, the employment of a revolving hot air or steam drum; but I do claim the reel, constructed as described, in combination with the hot air or steam drum arranged upon its shaft, whereby the cloth near the shaft may be dried equally with that upon the outer diameter of the reel, and thus equalize the shrinkage of the cloth throughout its whole length, in the manner set forth."

166. For an *Improved Mitre Machine;* George W. La Bau, Jersey City, New Jersey.

Claim.—"I claim the combination and arrangement, in the manner described, or in any manner equivalent thereto, of the several specific parts, or their equivalents, of the described mitre machine, without limiting myself to any particular arrangement of parts."

167. For an *Improved Hydro-Pneumatic Force Pump;* A. B. Latta, Cincinnati, Ohio.

Claim.—"I claim, 1st, Discharging the air from the cylinder before the end of the stroke of the piston, to move beyond the end of the cylinder and into the enlarged chamber. 2d, Inclining the top of the water chambers upward from the end of the cylinder to the discharge valve, in the manner set forth. 3d, The protrusion of the piston from the end of the cylinder at the end of each stroke, in combination with the upward inclination of the top of the chamber leading to the discharge valve, for the purpose set forth."

168. For an *Improvement in Coffins;* John McF. Lyeth, Baltimore, Maryland.

Claim.—"I claim the method of constructing marble slab coffins, so that the joints shall be tight and strongly secured to each other and to the bottom, and when raised by the handles, the weight shall come upon the bottom slab, substantially as described."

169. For an *Improved Regulator of Gas Burners;* William Mallerd, Brooklyn, N. Y.

Claim.—"I claim, 1st, The perforated cups or partitions, with their edged rings encircling the perforation, in combination with the perforated disk, valve, and the pin points to support it. 2d, The series of two or more valve chambers, with their valves, as described, each succeeding valve having a smaller perforation than the preceding one, and a slight increase of weight. 3d, Making the holes in the jet so as to burn at low pressure, in combination with a regulator."

170. For an *Improvement in Gas Burners;* William Mallerd, Brooklyn, New York.

Claim.—"I claim, 1st, Making the tip where the jet or jets of gas are burnt, of pure tin, or other metals of which tin forms a large proportion, thickly coated with tin. 2d, Making the tube and inner portion of burners of tin, or any metal thickly coated with tin, to prevent corrosion, and to avoid the use of solder. 3d, Punching the holes through the tips or jets of the gas burners, instead of drilling or sawing, which can be done by a hand punch, but with more accuracy and despatch by a small machine, for which machine I have applied for letters patent in England, in October, 1853, to be taken out in Michael Hollins' name by Newton & Son. The punching of the holes creating a smoother channel, obviates all the difficulties caused by sawing or drilling."

171. For an *Improved Double-Acting Force Pump;* J. H. McGowan, Jr., Cincinnati, O.

Claim.—"I claim the combination of an air-chamber communicating with the pump above all the valves, with a vacuum chamber communicating with the pump below all the valves, whereby the elevation of water is rendered more equable, and effected with a saving of power."

172. For an *Improved Fruit Picker;* John Mellendy, Southbridge, Mass.

Claim.—"I am aware that a fruit picker has been made of a common fork with two bent tines, arranged on top of a pole, and a basket suspended underneath the tines. I am also aware that a fruit picker has been made of a cylindrical vessel placed on the top of a pole, and having its upper edge armed with angular teeth raised on it; I therefore do not claim any such contrivances; nor the combination of a bifurcated pole and a basket hung to it; but what I do claim is, the application of the star or serrated cover or separator and the sliding basket on the pole, so as to extend entirely around it on the pole, and so that the serrated cover shall be stationary, relatively to the pole, and the basket be made to slide or move towards and away from the cover, and be operated substantially as specified."

173. For an *Improvement in Inhaling Tubes;* Daniel Einthorn, City of New York.

Claim.—"I do not claim inhaling tubes, for they have been long known and used; but what I do claim is, the bottle or flask with an air tight stopper, and a tube with its lower end submerged into said fluid. And also the inhaling tube in combination with the flask and tube."

174. For an *Improvement in Machines for Cutting Brads;* Wm. J. Miller, Cold Spring, New York.

Claim.—"I claim the arrangement of the vibrating shear in relation to the revolving shears or cutters, as connected, so as to change the position of the cutting edge of the vibrating cutter, and cause it always to stand parallel with the edge of each revolving cutter until the nail has been cut, substantially as set forth."

175. For an *Improved Road Scraper and Spreader;* Thomas Penrose, Ellington, Ill.

Claim.—"I claim the tail-piece, with its adjustable brace, when combined with a flat scraper having the points of attachment of its draft chains at its lower edge, in the manner described."

176. For an *Improved Charger for Fire Arms;* T. H. Peavey, South Montville, Me.

Claim.—"I claim the charger, consisting of the chambered cylinder confined between two plates, to one of which is attached a muzzle piece, or some suitable means of fitting it to the barrel, and furnished with a spring catch, or its equivalent, by which the chamber may be severally held in communication with the holes in the plates and the muzzle piece, substantially as set forth."

177. For an *Improved Trap for Animals;* Oliver Pier, Harmony, New York.

Claim.—"I claim the lever treadle, set or fall, and the elbow catch latch, in combina-

tion with the single and double prong grapple, together with the folded spring, specifically as described."

178. For an *Improvement in the Manufacture of Wooden Buttons;* L. L. Platt and A. L. Platt, Newton, Connecticut.

Claim.—"We claim manufacturing wooden buttons by cutting the 'blanks' from slabs which are of a greater thickness than the buttons are intended to be, and reducing said 'blanks' by pressure to the desired thickness, for the purpose of forming durable and well proportioned buttons."

179. For an *Improved Mortising Machine;* Hiram Plumb, Honesdale, Pennsylvania.

Claim.—"We claim cutting mortises by having two chisels forced gradually into the wood or stuff, and a reciprocating chisel or plane working between. The chisels cutting the ends of the mortise, and the chisel or planer cutting out the wood between them, the above parts being arranged as shown."

180. For an *Improvement in Winnowers of Grain;* B. D. Sanders, Halliday's Cove, Va.

Claim.—"I do not claim the valves or slides for regulating or modifying the blast in the several compartments of the blast spout, nor the spring traps, for they are well known; but I do claim the combination of the inclined screen (next adjoining the feeding hopper,) with the suction spout, subdivided into two or more compartments, the lower ends of the partitions extending downwards nearly to the screen, in the manner set forth."

181. For an *Improved Carriage Axle;* Wm. H. Sanders, Hastings, on Hudson, N. Y.

Claim.—"I do not claim, simply, enlarging an axle at the root, as this has been done; but I do claim the combination of a taper axle, having an enlargement at the root, with a box having a similar inside enlargement at its rear, and a diminution of size outside, provided with concentric rings or grooves for allowing it to be wedged in the hub, the whole being for the purpose of strengthening the axle without enlarging the box, and enabling me to use smaller hubs with a sufficiency of wood therein to preserve the necessary strength, substantially as represented."

182. For *Improved Calipers;* Perley Seaver, Oxford, Massachusetts.

Claim.—"I do not claim the precise form, nor the operating by a screw or springs, or a combination of a screw and spring: but I do claim making the pieces with the projections, when combined with cam B, with its nut, and operating as described."

183. For an *Improvement in Grinding Mills;* Isaac Straub, Cincinnati, Ohio.

Claim.—"I claim the combination of the permanently adjusted tram blocks for supporting the upper stone of the bridge tree, which is adjustable at both its ends, for supporting and adjusting the spindle and the lower stone or runner upon it, to the upper stone, substantially as described."

184. For an *Improvement in Steam Hammers;* Thos. Sumner, Paterson, N. Jersey.

Claim.—"I do not claim merely varying the direction of the blow, and employing for that purpose a hinged or rocking guide frame for the hammer to descend in, with lever to direct the descent; but I do claim the arrangement described, of the hinged guide frame which carries the hammer in relation to the anvil, by supporting the said guide frame on a trunnion below, situated at the back of one side of the anvil, and at the same level, or thereabouts, as that occupied by the bar or works under operation on the anvil; the said hinged guide frame being furnished with a counter-balance weight to facilitate and steady its swing, and relieve the swinging parts from strain when occupying an oblique position, substantially as specified, by which arrangement the hammer may be swiveled from the vertical towards the horizontal position on either side, into radial positions with that portion of the bar or work resting on the centre of the anvil, for the purpose of enabling the hammer to be worked across or around the bar, and to operate alike on its top and corners or sides, to give it a round, taper, or polygonal form in its transverse section, or otherwise work and shape, with convenience and despatch, and whereby the frequent handling or turning of the heavy bar or work is avoided."

185. For *Improved Head Gate for Water Wheels;* H. L. Turner, Strykersville, N. Y.

Claim.—"I claim the manner described, of constructing, arranging, and operating the head gates of re-action water wheels, for the purposes specified."

186. For an *Improvement in Ventilating Sewer;* Enoch Thorn, Philadelphia, Penna.

Claim.—"I claim the application of a self-acting valve to a common sewer, for the purpose of allowing the sewer to relieve itself of the compressed air which at times accumulates in it, so as to prevent the bursting of the sewer, or of its overflow into the streets, substantially as set forth."

187. For an *Improvement in Coffins;* Philo Washburn, Harrison G. O. White, and George A. Copeland, Taunton, Massachusetts.

Claim.—"We claim, 1st, A movable and adaptable head frame, round or otherwise, consisting of the following parts, viz: the head frame, the bar, the uprights, the head cushion, the straps, and the hooks. 2d, The method by which the cover is secured to the coffin, viz: the eyes, the hooks, the eyes and the thumb screws or pins. 3d, The facings of the edges of the lid, and its corresponding aperture with metal, all in the manner substantially as described."

188. For an *Improvement in Constructing Wire Bonnet Frames;* Henry Weed, Philadelphia, Pennsylvania.

Claim.—"I claim the method described, for forming wire framesfor bonnets, viz: by winding the wire round pins or stays, or their equivalents, arranged substantially as described, on a plate or board, thereby securing uniformity and exactness in every particular."

189. For an *Improvement in Whistling Tops;* W. E. Woodbridge, Assignor to Chas. Humphrey, Perth Amboy, New Jersey.

Claim.—"I claim the attachment, substantially as set forth, of a whistle or other instrument capable of producing a musical sound, without regard to the particular form of the top, or the mode in which it is set in motion."

190. For an *Improved Machine for Feeding Paper to Printing Presses;* William F. Collier, Assignor to Wm. F. Collier and Joseph Boyden, Worcester, Massachusetts.

Claim.—"I claim combining with the table (on which the paper is laid) and the sheet lifter, the bar or stand against which the sheet of paper is driven while being lifted from the pack. The object of such bar being to shake the sheet, or produce such a concussion thereon that should two sheets adhere together and be lifted, they may be shaken apart, so that while the upper one is further raised upwards, the lower one may be set free, so as to drop back upon the pack. Also, the combining with the lifter the sheet elevator, by which the sheet of paper is elevated or kept elevated, and deposited on the top of said lifter. Also, the combining with the rotary lifter, the projecting wing, lip, or plate, by which the sheet of paper is raised and presented to or upon the inclined planes or rests of the transferrer, as specified. Also, the transferrer, in combination with the exhausting lifter and the inclined rails, the same being employed to receive and transfer a sheet of paper from its place of deposit on the rails to the press rollers. Also, the mode of opening, holding open, and closing the jaws of the transferrer, viz: by means of the trigger catch lever, the two stops, and the spring applied to the upper jaw. Also, the movable sheet receder, in combination with the inclined rests, and mechanism, substantially as described, for elevating a sheet from the pack, and transferring it to the press rollers. And, also, The combining with the sliding or movable table on which the pile or pack of paper is deposited, mechanism for permitting it not only to fall or move towards the sheet lifter while the upper sheet of the pile is raised above the lifters, but to hold the table firmly in position while the sheet lifter is being moved away from it, or the pile of paper on it, as before stated."

191. For a *Process of Engraving or Printing upon Glass;* Milton D. and Lyman W. Whipple, Assignors to Lyman W. Whipple and Robert B. Fitts, Somerville, Mass.

Claim.—"We claim the within described method of engraving or lettering upon glass, an engraved metallic surface being caused to revolve or vibrate in contact with the surface of the glass, emery or other suitable cutting material being interposed between the bearing surfaces of the two. 2d, The method of causing the engraving cylinder to roll in contact with the surface of the article to be engraved, the parts which carry and give motion to the cylinder being connected with the vibrating lever, operated in the manner substantially as set forth."

192. For *Powder Channel to Doors of Safes and Bank Vaults;* F. C. Goffin, City of New York, Assignor to Alfred B. Ely, Boston, Massachusetts.

Claim.—"I claim the construction of channels or hollow chambers in connexion with

the doors of safes, vaults, &c., the same being open at top and bottom, and reaching from the lock to the bottom of the door, substantially as set forth."

193. For an *Improvement in Machines for Moulding for Metal Casting;* David Brown, Assignor to John F. Clark, Washington, D. C., and David Brown, Baltimore, Md.

Claim.—"I claim the arrangement of the pattern and piston plate surrounding the pattern, within a chamber or piston box, in relation to the half-flasks, operated on in the manner substantially as described, by which I am enablad to protrude the sand into the half-flask from said piston box or chamber, and around the pattern, and thus effect a compression of the sand at the parting, instead of at the central portion of the mould, (as has heretofore been done,) for the purpose of producing more perfect castings."

194. For an *Improved Pump;* Ira Carter, Champlain, New York.

Claim.—"I claim, 1st, The mode of attaching the lug described, made to the cylinder and the groove to contain the packing. 2d, The form and operation of the inducting valves being housed in by the lug of the cylinder, inclosing an air chamber between them, and closing the port holes on a circle section against the water after it passes them, thereby obviating lost suction. 3d, The form and principle of the core, which may be made a stationary part in a pump, or an operative part, by changing the locality of the induction valves only. And, 4th, The mode of oscillating by two cranks with friction wheels on their wrists being brought to act upon one lever between them, vertically attached to that part of the pump to be operated, said cranks being made firm on two parallel horizontal shafts, geared to revolve equal speed and gathering at the top."

195. For an *Improvement in Milk and other Evaporators;* A. F. Dalson, City of N. Y.

Claim.—"I claim the combination of the shallow pan with a rapid current of air underneath the cover, and thence through the central draft pipe, together with the apparatus for continual stirring, by means of the revolving cover and fixtures, substantially as described."

196. For an *Improvement in the Preparation of Archil;* Jonas Eberhardt, Philadelphia, Pennsylvania.

Claim.—"I claim the production of a bright and clear steam purple, without the use of any acid, after its being printed and steamed, as described."

197. For an *Improvement in Smut Machines;* Henry B. James, Trenton, N. Jersey.

Claim.—"I do not claim, separately, the parts specified; but I do claim the combination of the hopper, tank, spiral passage, and separator, effected by means of a common air-tight casing, in the manner set forth."

198. For an *Improvement in Heel Cutters;* Alfred D. Kelley, Rochester, New York; ante-dated March 20, 1854.

"I am aware that spring knives have been used in sole cutters, and that they have had screws adapted to them in such way as to change their form or forms according to the size of the sole to be cut by them; I therefore do not claim such; but I do claim the combination and arrangement of the flexible yoke, and its screw, with the spring blade, for the former or pattern, such flexible yoke and screw enabling a person to change the form of the cutting edge of the knife, or to adapt the knife to any pattern block, substantially as specified."

199. For an *Improved Magazine, Repeating, and Needle Gun;* Edward Lindner, City of New York.

Claim.—"1st, I do not claim the barrel containing the charges, but I claim the application of the rack situated between the gun barrel and the cartridge barrel, and the construction of the piston, in connexion with the said rack, for the purpose of pressing the cartridges into the revolving breech piece, substantially as described. 2d, I do not claim the needle for the purpose of igniting the priming; but I claim the spiral spring round the needle, together with the toggle joint at the upper end of the hammer, constructed as set forth, and acting upon the needle in such a manner that after said toggle joint has pressed the needle sufficiently far into the cartridge to ignite the priming, said toggle joint is forced upwards, allowing, thereby, the needle to spring suddenly back, and pass under the toggle joint by the action of the above mentioned spring, and by which quick retaining motion any heating of the needle is prevented. 3d, I do not claim the revolving breech piece with spiral grooves on the outside circumference; but I claim the arrange-

ment and manner of working the pin, by which the revolving breech piece is made to turn, substantially as described. 4th, I claim covering the bottom of the cartridges with a thin skin, to facilitate the piercing process of the same. 5th. I claim the ramming hammer, worked in the manner and for the purpose herein set forth."

200. For an *Improvement in Breech Loading Fire Arms;* Abner N. Newton, Richmond, Indiana.

Claim.—"I claim, 1st, The method of operating the sliding breech pin by means of the lever, the thumb lever, and the spring, all applied or attached to the arbor which forms the tumbler shaft, and operating substantially as set forth. 2d, Locking and unlocking the sliding breech pin by means of a locking piece which slides in grooves in the stock or shank of the gun, and a lever having a stud working freely in a slot of suitable form, in a plate attached to the same arbor as the levers, by which the breech pin is operated, the whole being arranged substantially as set forth. 3, Fitting the cock and tumbler, or other equivalents usually secured to the tumbler shaft, loosely to the said shaft, within the stock or shank of the piece, and causing the cock to be driven back to cock the piece, by means of a pin attached to the lever, by which the sliding breech is moved back and forth, whereby the sliding breech is allowed to return after the cartridge is introduced, and leave the piece cocked."

201. For an *Improvement in Combing Cotton and other Fibrous Material;* J. Noble, Leeds, England.

Claim.—"I claim, for the purpose of operating upon fibrous material, in the manner as set forth, and in combination with brushes and draw rollers, or their equivalents, the combining of two rotating rings of teeth, so that not only shall one rotate in and be eccentric to the other, but so that at or near one point of the revolutions of the two rings they shall come nearly or quite together, or in contact with each other, substantially as specified; such rings, by their co-operation in the manner set forth, being made to separate the long from the short fibres of the material, when subjected to the action, as explained."

202. For a *Ventilated Flour Barrel;* Thomas Pearsall, Smithboro', New York.

Claim.—"I claim the manner described of preventing fermentation of flour, meal, or other vegetable commodity, by dividing the bulk by means of air pipes or passages, arranged to run through the cask, whereby the flour is prevented from heating and becoming sour at the centre of the cask by the free circulation of the cold atmosphere or air through said tube."

203. For an *Improvement in Ploughs;* Jacob Revercomb, Botetourt, Virginia.

Claim.—"I claim the mode of fastening the points, the same consisting in the insertion of the key through an opening in the land side, in combination with a slot so placed in the stem of such points, that in the different or reversed position of the points, the slot shall be in place for the reception of the key."

204. For an *Improvement in Cordage Machinery;* Philos B. Tyler, Springfield, Mass.

Claim.—"I claim the regulator, substantially as described, wherein the tension of the strand so acts upon a friction brake as to make a uniform resistance, and consequently a uniform tension of the strand or thread."

205. For an *Improvement in Kerosene Burning Fluids;* Abraham Gesner, Williamsburgh, New York, Assignor to the Asphalte Mining and Kerosene Gas Company, City of New York.

Claim.—"Having claimed, under separate specifications, the B and C Kerosene, in this, I claim as a new manufacture or composition of matter for illuminating and other purposes, the liquid hydro-carbon herein described, which I denominate 'A Kerosene.'"

206. For an *Improvement in Kerosene Burning Fluids;* Abraham Gesner, Williamsburgh, New York, Assignor to the Asphalte Mining and Kerosene Gas Company, City of New York.

Claim.—"Having claimed, under separate specifications, the A and B Kerosene, in this, I claim as a new manufacture, the composition of matter for illuminating and other purposes, the liquid hydro-carbon herein described, which I denominate 'C Kerosene.'"

207. For an *Improvement in Kerosene Burning Fluids;* Abraham Gesner, Williamsburgh, New York, Assignor to the Asphalte Mining and Kerosene Gas Company, City of New York.

Claim.—"Having claimed, under separate specifications, the A and C Kerosene, in this, I claim as a new manufacture or composition of matter for illuminating and other purposes, the liquid hydro-carbon herein described, which I denominate 'B Kerosene.'"

RE-ISSUES FOR JUNE, 1854.

1. For an *Improvement in Drying Grain;* Henry G. Bulkley, Kalamazoo, Michigan; patent dated March 2d, 1852; re-issue dated June 27, 1854.

Claim.—"I claim the method of seasoning or kiln drying substances, by using steam in a vessel which has an opening communicating with the atmosphere to limit the pressure, for the purpose of transmitting caloric to the substances to be seasoned or kiln dried, or the vessel or vessels containing them."

2. For an *Improvement in Sewing Machines;* I. M. Singer and Edmund Clark, City of New York, Assignees of Charles Morey and Joseph B. Johnson, Boston, Mass.; patent dated February 6, 1849; re-issue dated June 27, 1854.

Claim.—"We are aware that an adjustable bar has been made use of to hold the cloth to the bar, and prevent it from being retracted by the withdrawal of the needle, and we therefore lay claim to no such device; but what we do claim is, the spring or curved arm for the purpose of holding the cloth to the surface of the feeding apparatus by a yielding pressure, in the manner set forth."

3. For an *Improvement in the Mode of Dressing Mill Stones;* Elisha S. Snyder, Charlestown, Virginia; patent dated Feb. 10, 1840; re-issue dated June 20, 1854.

Claim.—"I claim the mode of dressing mill stones in ridges and furrows, and also in furrows and lands tangential to the eye, each furrow and land gradually increasing in width, and the furrows in depth, from the eye to the circumference, being of a triangular shape in its vertical cross-section, and every alternate ridge or land being omitted from the eye to the circle forming large triangular cavities for the admission of the grain to be broken preparatory to its passing to the long furrows to be ground into flour. Also, the form of dress for mill stones, either for the ridges, or the lands, or the furrows, separately, or, as combined as above described, in ridges and furrows, or in lands and furrows. I do not claim ridges, or lands, or furrows, these being old devices in mill stone dressing; but I claim the tangent form or shape given to the ridges, and lands, and furrows."

DESIGN FOR JUNE, 1854.

1. For *Cooking Stoves;* Apollos Richmond, Assignor to A. C. Barstow & Co., Providence, Rhode Island; dated June 13, 1854.

Claim.—"I claim the music staff, raised figures, and ornamental configurations, for the side and front plates."

JULY 4.

1. For an *Improvement in Potato Diggers;* Galusha Jonas Bundy, Lynden, Vermont.

Claim.—"The inclined fingers, in combination with a scoop, have been heretofore employed in a machine for digging potatoes, and to such fingers a vibratory motion has been imparted, in order to separate and discharge the earth, the earth being made to drop through the spaces between the teeth or fingers, whilst the potatoes are forced up the inclined plane formed by the fingers, and for the purpose of loosening the ground or reducing its surface to a finer state than it was previously, there is nothing new in employing on a mould board a horizontal plate and vertical cutters, extending upward from two to three inches therefrom; I therefore do not claim any such inventions; but I claim my improvement in the construction of the mould boards of a potato plough, or the making them with slots or passages standing vertically or nearly so, and having their respective planes parallel to a vertical plane passing through the draft beam of the machine."

2. For an *Improvement in the Construction of Salt Evaporators;* Henry G. Bulkley, Kalamazoo, Michigan.

Claim.—"I claim the employment for boiling salt, or for any evaporating process of a similar nature, of a series of pans arranged in communication with each other, and heated by a pipe or flue passing through them in succession, so as to heat the brine, or other solution, and cause the deposit of the impurities previously to its entering the pan in which the crystallization or final boiling takes place."

3. For an *Improvement in Screw Wrenches;* Ary G. Coes, Worcester, Mass.

Claim.—"I claim the arrangement of the elevating screw (made as a male screw,) of the tube, in the external surface of the tube, and so as to extend below the milled head and the screw, in combination with the arrangement of the screw (made as a female screw) within a socket tube on the handle."

4. For an *Improved Machine for Bending Felloes;* Thomas Cox, Lancaster, Penna.

Claim.—"I claim the combination of the vibrating felly mould with the flanched bending wheel, arranged as described. Also, the manner of perfectly bending the last end of each felly, and securing it, when completely bent, upon the mould, viz: by the combined action of the bending wheel, and of the wedge clamp."

5. For *Improved Mechanism for Operating Saw Mill Carriages;* A. S. T. Copeland, Pittsburgh, Pennsylvania.

Claim.—"I claim the combination of the triangularly working shaft, the mechanism for shifting it into and out of gear, with the right and left handle endless screws, in any manner substantially the same as described."

6. For an *Improved Machine for Creasing and Beveling Barrels;* Archibald H. Crozier, Oswego, New York.

Claim.—"I claim the movable platform and movable cutters, arranged so that the cutters may be moved from the barrel, and free from the crease when the platform and barrel descend, and moved towards the barrel when the platform and barrel are raised."

7. For an *Improvement in Sofas, Crib Bedsteads, &c.;* T. W. Currier, Lawrence, Mass.

Claim.—"I claim the combined arrrangement of the cam wheels and the rockers carried by the cam wheels, whereby, by rotating the cam wheels, the chair or sofa can be raised or lowered at pleasure, and also the rockers brought into play when desired."

8. For an *Improvement in the Preparation of Collodion for Photographic Pictures;* James A. Cutting, Boston, Massachusetts.

"The nature of my invention consists in the use of gum camphor in addition to the existing materials, in the preparation of collodion for positive photographic pictures on glass."

Claim.—"I claim the use of camphor, in combination with iodized collodion, as set forth."

9. For an *Improvement in Finishing Palm Leaf Hats;* Dexter Dennis, Barre, Mass.; ante-dated January 4, 1854.

Claim.—"I claim the covering the outer surface of the hat holder with the stiffening composition, and applying the hat thereon, and subjecting it to the action of the heating flats. Also, the combination of the round corner flat with the crown and side flats, so as to operate in connexion with them, as specified. Also, using a hat holder, elliptical or oval, in its horizontal section, in combination with applying to the side flat a spring bar or contrivances that will allow it to spring or move while the hat holder is revolved, and adapt itself to such hat holder, as specified. I claim, in combination with the top or crown flat and the elevating and depressing machinery thereof, a fan apparatus, to regulate its downward descent on the hat. And, in combination with the frame and the crown flat, the toggles and levers, and the projection, the springs and connecting cords, the whole being to enable the frame and the top or crown flat to be operated, substantially as specified."

10. For an *Improved Valve for Wind Musical Instruments;* C. H. Eisenbrandt, Baltimore, Maryland.

Claim.—"I claim arranging the rotating valve on a pivot axis, the extremities thereof pointed, or arranged so as to work in the ends of an adjusting screw passing through an

elbow support attached to the cap of the air chamber, and the end working in a tightening screw rest; the said valve axis attached to a rotating double jointed lever device, combined with the finger plate; the said pivot axis rotating valve device being used in combination with a common sewing needle spring, or its equivalent, passing through the yoke or lever rest, the end or point of the spring resting on the upper side of a projection or spur. The whole claimed as a combination, whereby a perfect trill or shake can be produced, and the same modulated so as to readily afford the crescendo and decrescendo effect, which has never heretofore been accomplished in the valves of brass wind musical instruments. I do not confine myself to any particular construction of lever, combined with the common needle spring, or its equivalent, to produce the new and important effect."

11. For *Mill Stone Dress;* William Finkley, Cole Creek, Indiana.

Claim.—"I claim the skirt furrow, isolated both from the leading and from the intermediate furrow or furrows, for the objects before stated, but parallel to the succeeding leader, in order to facilitate the delivery of the meal as it is ground, either in connexion, or otherwise, with the flared and deepened entrances of the leading furrows, as described."

12. For an *Improvement in Lightning Rods for Vessels;* R. B. Forbes, Boston, Mass.

Claim.—"I do not claim the system of permanent conductors as applied to the mast of a vessel, in the manner well known as that of Sir William Snow Harris, wherein the conductor is carried down the mast, and through the hold and keel of the vessel; nor do I claim either the common chain or rod conductor, nor the mode or modes of applying the same; nor do I claim to make the conductor of fixed lines of metal, and to extend down the mast to near the lower mast head, and from thence down the after swifters to the ship's side; nor do I claim to make that part of the conductor extending down on the after swifter or shroud, as one long tube of metal; but what I do claim is, composing it of a system of socket tubes and slide tubes, and confining the same to one of the shrouds or the rigging, and over and against the outside of the hull, and either to the copper sheathing thereon, or down to such a depth on the hull that the lower end of the conductor shall always remain immersed in the water under the ordinary rolling or pitching of the vessel while at sea, all substantially as specified."

13. For a *Sub-Marine Battery;* Joseph Frey and D. B. Burnham, Battle Creek, Mich.

Claim.—"We claim our arrangement of guns in the hull of a boat under water, with port holes and gates, in such a manner as the guns may be loaded and fired at pleasure."

14. For an *Improvement in Quartz Crushers;* Heman Gardiner, City of New York.

Claim.—"I claim, 1st, Suspending the basin at the centre by a fixed shaft above a bed, whereby, while every part of its circumference is in turn depressed by an arm and roller, or their equivalents, revolving on the shaft, the lowest part of the basin where the greatest weight is, always rests upon the bed, and the shaft is relieved of the greater portion of the weight of the basin and its contents. 2d, The supplemental ball, suspended or attached from the pulley, or its equivalent, revolving above the basin, so that it is always in contact with the inclined part of the basin where the quartz or ore is most thinly distributed."

15. For an *Improvement in Steam Boilers;* Thomas Greer, Philadelphia, Penna.

Claim.—"I claim a series of angular tubes, arranged and for the purpose as specified."

16. For an *Improvement in Milk Strainers;* Joel Gleason, Geneva, New York.

Claim.—"I claim the combination of the packing with the hinged catches, the strainer being supported on the pail by means of the packing, in combination with the catches, and the packing being fixed to the body of the strainer by locking the tin on to the packing on the underside of the body of the strainer."

17. For *Improved Machinery for Punching Rivet Holes in Hose;* John R. Hague, Pittsburgh, Pennsylvania.

Claim.—"I claim the use of the sliding table and the pressing board, in combination with the rack work, the lever, and the finger, for the purpose of moving forward the leather on the sliding table during each stroke of the punching gate, and in combination with the punching gate and punches."

18. For an *Improvement for Regulating the Motion of Steam Engines;* William C. Hibbard, Boston, Massachusetts.

Claim.—"I claim the 'isochronal eccentric,' substantially as described, as a device to

be used in machines for moving steam valves, or for other similar purposes. Also, the combination of the isochronal eccentric with a governor or regulator, in such a manner that the governor or regulator shall control the amount of its eccentricity, and thus by the variable movement of the valves, regulate the velocity of the engine."

19. For an *Improvement in Reading and Writing Stands;* E. Hidden, City of N. Y.

Claim.—"I claim, 1st, The combination of the double jointed bracket and screw for adjusting the position of the desk, both horizontally and vertically, as set forth. 2d, The application of the sliding clasps with an india rubber or other elastic band for securing books, papers, &c., in the position desired, as set forth. 3d, The mode described, of fixing the bracket, supporting the lamp or candle holder, admitting of adjustment at every angle the desk may be placed in."

20. For an *Improvement in Spike Machines;* Fenton Humphrey, Boontown, N. J.

Claim.—"I claim, 1st, The manner of pointing, by which I obtain a change in the place of labor on the rollers at every revolution. 2d, The general construction, arrangement, and combination of the levers, for the specified purposes."

21. For an *Improvement in Seed Planters;* Samuel Ide, East Shelby, New York.

Claim.—"I claim the series of connected chambers or recesses around the centre of the rotating cog wheel, whereby a uniform and continuous distribution of the seed is effected."

22. For an *Improved Catch for Vault Covers;* J. K. Ingalls, Williamsburgh, N. York.

Claim.—"I claim the additional lip or nose, with the recess, for the eye of the cover to fit into and hold the catch, unlocked, as arranged in relation to the other parts of the catch or lock, and operated as set forth."

23. For an *Improvement in Washboards;* Philip H. Keck, Morgantown, Virginia.

Claim.—"I claim the construction of the washboard, with the chamber and closely fitting slide, in combination with the channel and openings, for furnishing a constant supply of water to the clothes."

24. For an *Improvement in Ore Stamping Machines;* J. F. Laird, Philadelphia, Pa.

Claim.—"I claim the arrangement of the lifters by being so placed as to operate on the periphery of the tappet head, for the purpose of giving the stampers a partial rotation without requiring other mechanism."

25. For an *Improvement in Controlling Draft in Brick and Lime Kilns;* J. Leeds, Philadelphia, Pennsylvania.

Claim.—"I claim controlling or regulating the draft of lime, brick, or other kilns, by means of a double dome, in the under one of which the openings are at its outer edge, and in the centre of the upper one, so as to force the draft from the centre to the outside of the kiln. Also, in combination with kilns controlled by the double domes, the main or auxiliary chimney for increasing the draft in the kiln."

26. For an *Improvement in Paddle Wheels;* Wm. H. Muntz, Norton, Mass.

Claim.—"I claim attaching each of the said paddles or floats to wheels or rims, wherein that to which the broad surface of each of the paddles is attached, is of greater diameter than the other, and the position of the paddle is in or about in a line parallel to a radial line, or one drawn through the centre of the wheel shaft, and the face of the paddle is oblique to the plane of this line, which stands perpendicularly to the axis of the shaft."

27. For an *Improvement in Horse Powers;* John A. Pitts, Buffalo, New York.

Claim.—"I claim the boss and set screws, in combination with the bridge-piece, for the purpose of adjusting the spur gear and bevel wheels to the main driving wheel, to prevent binding or cutting, as described."

28. For an *Improvement in Cast Iron Car Wheels;* Benj. Severson, Philadelphia, Pa.

Claim—"I do not claim any part of the rim nor hub, nor connecting them with a solid web; neither do I claim common corrugations nor brackets; but what I do claim is, a cast iron web deeply corrugated where it joints to the rim, with the corrugations gradually lessening in depth as they approach towards the centre of the wheel, so as to wholly disappear at or near the hub, when it is used for the purpose of uniting a rim and hub, and has its central part strengthened by means of brackets."

29. For an *Improvement in Brick Kilns;* John S. Speights, Baltimore, Maryland.

Claim.—"I do not claim constructing the kiln with air passages between the fire beds; but I claim the long grates with air passages which extend clear through the kiln below them, and have doors to admit the air at either or both ends, in combination with small air passages between them, having lateral openings to throw the air under the middle of the fire, for the purpose of regulating the admission of the air to any part of any grate or every grate, so as to regulate the combustion, and thereby regulate the heat in all parts of the kiln."

30. For an *Improved Beveling Plane;* M. J. Wheeler, G. W. Rogers, H. W. Pierce, and M. B. Tidy, Dundee, New York.

Claim.—"We claim attaching the two bevel cutters to two rings which are hinged by a three-flanched hinge, or otherwise so secured to the body of the plane as to be capable of swinging a certain distance around a common pivot or axis, for the purpose of being adjusted to set their faces and the edges of their cutters at any angle to each other, and to the face of the fence."

31. For an *Improved Mode of Hanging Bells;* Jerome B. Young, Harper's Ferry, Va.

Claim.—"I claim the construction of a bell, having attached thereto an arm formed on a tube, having working through it an actuating lever, combined with a gravitating piston striker working through a barrel or socket attached to the elbow and arm; the whole used together with the tympanum, and combined in its application with the door of a dwelling, or otherwise."

32. For an *Improvement in Cement Compounds;* Wm. H. Poindexter, Fayette County, Tennessee, Administrator of John S. Remington, deceased, late of Macon County, Alabama.

Claim.—"What is claimed is, the use of cotton seed ashes, or the ashes of any other oil yielding vegetable substance, as an ingredient of a cement, substantially as set forth, whether it be mixed with rosin and earthy matters, or with oil and earthy matter."

33. For an *Improvement in Knitting Machines;* Henry Burt, Assignor to Newark Patent Hosiery Company, Newark, New Jersey.

Claim.—"I claim, 1st, The hollow bar, or its equivalent, in combination with the extended ends of the sinkers, for the purpose described. 2d, The radius bar, constructed and operating as described, in combination with the cylinder and the collar."

34. For an *Improvement in Purifying Oils;* Thos. Drayton, Brooklyn, Assignor to G. W. M'Cready, City of New York.

Claim.—"I claim the mode or process of using the above purifying oils, and producing a burning fluid."

35. For an *Improvement in Sewing Machines;* Wm. Butterfield, Assignor to himself and Edgar M. Stevens, Boston, Massachusetts.

Claim.—"I do not claim the combination of a needle slide and hooked needle, wherein the slide is made to operate so as to close or cover the hook, and prevent it from catching in the fabric while it is being drawn through the same; nor do I claim any arrangement of applying the closing slide of a hooked needle to the same side of a needle as is the barb or hook, so that such slide may slide in a groove in the needle (or carrier thereof) parallel to the motion of the needle; but what I do claim in the chain stitch sewing machine, operating with a hooked needle, or hook to draw the thread through the material to be sewed, is the 'rest cast-off,' in its combination with the hooked needle, and as applied to and made to operate with it and the material to be sewed, and in the loop of thread. Also, the improvement by which the rest cast-off is rendered capable of adapting itself to any ordinary thickness or variation of thickness of the fabric or article to be sewed; such improvement consisting in the described mode of operating it by the spring applied to the carrier lever, and made to operate on the lower end of the recess. I do not claim the application of a spring to the bobbin for the purpose of enabling the bobbin to fall or turn backward, and to take up the slack of the thread; but what I do claim is, the combination of the bobbin holder with the spring, the friction disk, and the axle on which the holder turns, the same enabling an empty bobbin to be removed from the holder, and a full one put in its place, without disturbing the connexion of the spring with the bobbin and friction plate or disk."

36. For an *Improvement in Self-Acting Cheese Presses;* Solomon W. Ruggles, Assignor to himself, Artemus R. Smith, and J. O. Austin, Fitchburgh, Massachusetts.

Claim.—"I claim the general construction and application of the pressing power or mechanism, or the arrangement of the pressure bars or struts, and the arms or pitman, and their application to the remaining stationary and movable parts of the press, whereby the press is made to operate in manner as explained, and to great advantage and power, and with little friction, and is reduced to a very desirable and compact form."

37. For an *Improved Machine for Excavating Earth;* John Taggart, Roxbury, Assignor to himself and Richard Pitts, Dorchester, Massachusetts.

Claim.—"I claim the combination of the gravitating weight and its line with the windlass barrel and the brake wheel, so as to operate automatically, and rotate both windlass and brake wheel, and not only take up the slack of the rope while the scoops are being elevated, but at the same time to set the brake wheel ready for the action of the brake, when it becomes necessary to drop the scoops in order to discharge their load. I do not claim the employment of a single line and two branch lines applied respectively to the two scoop levers, and independently of their boom; but I claim the arrangement of the branch lines of the line, so as not only to operate through the ends of the scoop levers, but also through guiding or sheave passages of the boom, such an arrangement of the branch lines producing an increase of draft on the scoop levers during the operation of closing them. I also claim, in combination with the afore-described arrangement of the line, through the sheave openings of the boom, and the two scoop levers, or about their sheaves, the union of the branches into one line, in connexion with the carrying such line through a compensating passage of the boom, and permitting it to slide freely through the same, in manner as described, the same being for the purpose of enabling the scoops to close together or upon an object whenever the movement of one of them during the operation of closing them together is arrested by contact with an obstacle, as explained. I am aware that a single scoop has been applied to a boom, and that boom made to slide through a slotted horizontal rocker shaft projected over the side of a screw. Also, that double scoops have been applied to a boom or an upright frame made to have vertical movements, and to work through a derrick or platform. I do not, therefore, claim any such applications of a boom of a single scoop, or the supporters of a set of scoops; neither do I claim the combination of a rocker tube or eye with a rocker frame, as described, and for the purpose of obtaining a compound movement; but I do claim the combining the boom and the working ropes of it and its scoops with a crane, substantially as specified, so that the scoops may be free to be moved not only vertically, but also in any direction, either towards or away from, or laterally with respect to the crane and its platform, whereby, while the scoops are grasping a stump, or other article adhering to the mud or earth, a lateral movement of the crane may be employed to effect leverage on the scoops in a lateral direction, so as to aid in disengaging the stump or article grasped by the scoops, and to effect this without injurious strain on the boom, or the parts through which the boom slides."

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38. For an *Improvement in Making Wrought Iron Car Wheels;* George B. Hartson, City of New York.

Claim.—"I claim the converging or centripetal pressure rolls, arranged and operating to form a tread or rim on the outer margin of a thin disk of metal, by thickening the said margin, and moulding it into the required shape, whether the sides of the disk within the rim be supported by clamp rolls or not, and also whether the disk be heated simultaneously with the compression or not."

39. For a *Gas Heating Apparatus;* Charles M. Guild, Brooklyn, New York.

Claim.—"I claim the opening and closing of the valve which admits the gas to the heating apparatus by the act of placing and removing the vessel or thing to be heated. Also, the small perforations leading from the gas pipe to the burner or heating apparatus, acting independently of the valve, for the purpose of admitting a jet of gas, barely sufficient to keep up the flame, without unnecessary consumption of gas, when the heater is not in immediate use, or when one article is removed, and before another takes its place."

40. For a *Coal Sifter;* Elisha French, Braintree, Massachusetts.

Claim.—"I claim a coal screen in a box fitted with a sliding top and ends, and with rockers placed at right angles to each other on the bottom."

41. For an *Improved Slide Valve Motion for Steam Engines;* Martin V. B. Darling, Providence, Rhode Island.

Claim.—"I claim, 1st, Combining the cam and yoke motion for opening the steam port, and the eccentric or cam and yoke motion for closing the steam port, and causing the two motions to act on the valve, by connecting with the valve the yoke rod of the cam and yoke motion, which gives the movement for opening the port, and furnishing the rod of the eccentric or cam motion, which gives the movement for closing the valve, with an eye, or its equivalent, which plays between two stops or tappet pieces properly arranged on the rod. 2d, Giving to the eccentric or cam which gives the movement to close the valve a greater throw than the cam which opens the valve, in order that at the proper time the valve may be made to close the steam port and cut off the steam very quickly, or by a very small part of the revolution of the main shaft."

42. For an *Improvement in Camphor Wash Mixtures;* C. W. Crozier, Knoxville, Tenn.

Claim.—"I claim the combination of the several ingredients with camphor, without the latter substance; the only ingredient that contains the qualities of an essential or volatile oil would be the turpentine. By the addition of the camphor, we have the peculiar qualities of the oil increased. 'Volatile oil occurs in every part of odoriferous plants.' (Ure's Dictionary.) 'Berzelius considers camphor a stearoplene,' (U. S. Dispensatory, page 155.) Stearoplene, or stearine, having the same import, is the solid constituent of fatty substances, as of tallow and olive oil, converted into a crystalline mass by saponification with alkaline matter, (Ure's Dictionary.) Fatty matters, when subjected to the action of alkaline leys, undergo a remarkable change, being converted into three different acids, called stearic, margaric, and oleïc, (Ure's Dictionary, page 1148.) Soap, in the most extended signification of the term, embraces all those compounds which result from the reaction of salifiable bases in oils and fats. These consist of three principles, two solid, differing in fusibility, called stearine and margarin, and one liquid, called olein, of which there are two varieties; stearine characterizes the fats which are firm and solid, as tallow, &c. From these facts, there is no doubt of the saponaceous qualities of the camphor, and its power as a detergent, and that it is a very important and valuable addition to the wash mixture."

43. For an *Improved Arrangement for Mooring and Managing Balloons;* John W. Brewer, Cincinnati, Ohio.

Claim.—"I claim the plan of building, and the arrangement of the necessary machinery, together with a stationary steam engine, gas generators, &c., therein set forth, for mooring and managing balloons."

44. For an *Improvement in Harvester Rakes;* Collins Brown, Upper Alton, Illinois.

Claim.—"I claim imparting the required movements to the rake, by combining with its handle the horizontally vibrating fulcrum lever, and the outer end of the lever, which has a compound vertical and horizontal movement imparted to it by means of the crank pin, pivot, nut, and the curved slotted inner portion of said lever."

45. For an *Improved Implement for Blasting Rocks;* C. F. Brown, Warren, R. I.

Claim.—"I claim blasting rocks by placing the powder or charge within a tube or case, and between two heads attached or connected to a rod, and provided with suitable packing, one of said heads being movable upon the rod, and secured at the desired point by a nut or its equivalent, the tube or case being inserted in a hole or aperture drilled in the rock, the diameter of which corresponds to that of the tube or case."

46. For an *Improvement in Foundations for Pavements;* J. B. Wickersham, City of N. Y.

Claim.—"I claim the employment, as a foundation for pavements, of a lay of woven, or interlaced, or other iron work, laid upon a bed of any suitable material, substantially as described."

47. For an *Improvement in Parallel Motion of Beam Engines;* John M. Thompson, Taunton, Massachusetts.

Claim.—"I claim producing a parallel motion by connecting the link to one end of a radius rod, whose other end is attached to a crank or arm on a rock shaft placed under the centre of the beam, and receiving a motion from the same by gearing."

48. For a *Machine for Mortising Sash Stiles;* J. B. Smith, Milwaukie, Wisconsin.

Claim.—"I claim the arrangement of the parts so as to constitute a machine capable

of mortising both ends of sash stiles of any desired length, and cleaning out the mortises simultaneous with their completion, without the necessity of reversing the ends of the stiles, or tightening or slackening the driving belt. Also, the combination and arrangement of the vertical power chisels and the stationary chisels with the movable bed and sliding carriage, or their equivalents, independent of the arrangement of the driving belt, when used for mortising sash stiles of only one length, and cleaning out the mortises."

49. For an *Improvement in Trap Doors;* Gustavus Runge, Philadelphia, Penna.

Claim.—"I claim the application to trap doors of hatchways of counterbalances, hidden from view, working between the flooring and ceiling, substantially as specified, and the attachment of the hinges to the under side of the trap door, to avoid all obstructions on the top of the same, and making one smooth surface with the flooring above, as shown and described."

50. For a *Method of Applying Water to Compound Buckets of Flutter Wheels;* David Rankin, Augusta County, Virginia.

Claim.—"I claim the so arranging of cuneiform buckets upon the radial arms of flutter wheels, so that in passing through an eccentrically formed water way, three buckets shall receive the volume of water, in about the proportions described."

51. For *Improvements in Plating Metals;* Robert G. Pine, Newark, N. J.

Claim.—"I claim plating articles, by fitting said articles within a female die formed by thin sheet metal, or any other material, which is placed upon an elastic bed, the foil and solder being placed between the female die and article, and forcing a male die in a heated state upon the article, for the purpose of fusing the solder and causing the foil to adhere and become firmly united to the article, as set forth."

52. For an *Improved Sawing Machine;* Charles F. Hackard, Greenwich, Conn.

Claim.—"I claim the combination of the vertical circular saw, or a vertical reciprocating saw, and the horizontal saws, when said saws are constructed in the manner shown."

53. For an *Improvement in Horse Powers;* William M'Cord, Sing Sing, N. York.

Claim.—"I claim the precise manner of combining the parts specified, so as to produce an anti-friction horse power."

54. For an *Improvement in Gas Stoves;* Andrew Mayer, Philadelphia, Penna.

Claim.—"I do not claim the perforated distributing disk, for that has been employed; nor placing pummice stone or other incombustible material in the frame for retaining the heat, for that is well known; but I claim the arrangement of the tube, hot air chamber, and disks, as described."

55. For an *Improvement in Eyelet Machines;* Hymen S. Lipman, Philadelphia, Pa.

Claim.—"I claim, in combination with a fastener and a reservoir of eyelets, the converging apparatus for carrying the eyelet from one to the other. Also, the threading of the eyelets upon a rod or stem, from which they may be delivered, one at a time, to the carrying apparatus."

56. For an *Improvement in Lightning Rods;* Amos Lyon, Worcester, Mass.

Claim.—"I claim the metallic surface lightning rod, made in the form described, or in any and every form, where sheet copper, sheet brass or iron, (either of which may be coated with metal or not,) and where the surface is all or nearly all exposed to the electrical atmosphere, and is adapted to present points upon its edges throughout its entire length, according to the mode described."

57. For an *Improvement in Apparatus for Detaching Harness from Horses;* Samuel Hunt, Baltimore, Maryland.

Claim.—"I claim uniting the two sections of a saddle tree by a tongue projecting one section and fastened in a corresponding groove in the other, by a metal shaft and spiral spring, the whole being entirely concealed from view. Also, arranging a set of terrets in two sections, each fitting into a dove-tailed groove in the top of the front of one section of the saddle tree."

58. For an *Improvement in Ornamenting Metallic Buttons;* Hiram W. Hayden, Waterbury, Connecticut.

Claim.—"I do not claim combining a series or cluster of bright and deadened punches

in one die, to produce the whole design or figure by one blow of the die, as this has been done. I claim the method of ornamenting metallic buttons and similar articles, by submitting the same to the separate operations of deadened and bright dies, constructed substantially as specified."

59. For an *Improved Mode of Connecting Water Pipes;* Jonathan Ball, City of N. Y.

Claim.—" I claim the cock attached to the metal tube, in combination with the boring tool inserted through the cock, by which the pipe and cement is perforated, in the manner and as specified."

60. For an *Improved Mode of Arranging Arch Boards for Cistern Arches;* H. Crosby, Gustavus, Ohio.

Claim.—" I claim the construction of an arch board of a combination of angular curved segments or sections, secured together by hooks and dowels, or their equivalents, arranged in the manner described; this arch board I claim in its application to the purpose specified."

61. For an *Improvement in Composition for Making Photographic Pictures;* James A. Cutting, Boston, Massachusetts.

Claim.—" I claim, 1st, Displacing the water from the cotton for this purpose, with strong alcohol, as set forth. I do not claim the use of alcohol as a desiccating agent, but limit my claim to its special use and purpose, as herein stated."

62. For an *Improvement in Photographic Pictures on Glass;* James A. Cutting, Boston, Massachusetts.

Claim.—" I am aware of the previous use of balsam for the cementing of lenses, and the securing of microscopic objects, and other like purposes, and do not, therefore, extend my claim to any of these uses; but I claim the combination of balsam with photographic pictures on glass, and with the additional glass, by which they, with the balsam, are hermetically sealed, as described, and for the purposes set forth, and for no other."

63. For an *Improvement in Ventilating Railroad Cars;* G. F. Foote, Buffalo, N. Y.

Claim.—" I claim the arrangement and construction of the apparatus described, or other mode substantially the same, for ventilating a railroad car with purified or heated air, or both, as set forth; and I also claim the diffuser and its equivalents, for the uses and purposes specified."

64. For *Improved Cements of Boiled Coal Tar and Earths;* Henry P. Gengembre, Alleghany City, Pennsylvania.

Claim.—" I claim the process of preparing fusible marble by adding asphaltum or mineral pitch, aluminous clay, calcareous loam, and silex, in or about the following proportions, viz: aluminous clay, 60 to 75 per cent.; calcareous loam, from 10 to 20 per cent.; pitch, from 30 to 40; and silex in quantity sufficient to give the desired hardness. The quantity of pitch to be increased or reduced, according to the temperature or purposes for which the manufactured article is to be used."

65. For an *Improvement in the Construction of Ink Stands;* Robert T. Fry, Philadelphia, Pennsylvania.

Claim.—" I claim a two part inkstand, with the elastic disk secured to the upper part or half; said two parts being held together air tight by a flanched cap or ring, and so that access may be had to the ink reservoir without disturbing or removing from its part the elastic diaphragm."

66. For a *Chair Cane;* Rufus Porter, Washington, District of Columbia.

Claim.—" I claim constructing a chair or table by hinging four arms and four legs to a hub or hubs attached to or mounted upon a central vertical shaft, and supporting said arms and legs by radial braces, which connect said arms and legs to sliding sockets in such a manner that said arms and legs may be closed up to a compact form, as described."

67. For an *Improvement in Diaper Pins;* J. Rabbeth, East Hartford, Connecticut.

Claim.—" I claim the combination of the slotted tube, arranged in the manner set forth."

68. For an *Improvement in Cow Catchers;* Thomas B. Smith, Triune, Tennessee.

Claim.—" I claim the beam or scraper, in combination with the nut piece and screw,

arranged and operating to produce the alternate lateral movement of the beam over the surface of the cow catcher."

69. For an *Improvement in Condensers for Steam Engines;* Franklin G. Smith, Columbia, Tennessee.

Claim.—"(Tubular *condenser* for steam engines.) Whereas, in the operation of the tubular condenser, especially if the attempt be made to work without the injection of cold water, there is much difficulty found in effecting the instantaneous transmission of the caloric of the steam through the metal forming the tube of the condenser, on account of the thickness of the metal necessarily used on the plans heretofore adopted to secure the requisite strength for resisting the force of the atmospheric pressure: I claim the mode of constructing such tubes by which the two offices of assisting the atmospheric pressure, and transmitting the caloric of the steam to the surrounding cold water through the intervening metal of the tubes, are separated; the pressure resisting strength being gained from an interior tube of stiff metal having innumerable holes punched through it, and this being surrounded by a water-tight covering of thin sheet copper, or other suitable material, against the internal face of which the steam impinges by passing through the perforations in the strong inner tube, and is thus brought into the nearest possible contact with the surrounding cold water."

70. For an *Improvement in Machine for Planing Stones and Metals;* Josiah M. Smith, City of New York.

Claim.—"I claim the revolving disk containing a series of cutters, sufficient for completing the planing of a portion of the surface of an object, in combination with the rest or slide."

71. For a *Ship Ventilator;* Willet Thompson, New Haven, Connecticut.

Claim.—"I claim the construction of deck ventilators for ships, the combination and arrangement of the elevating spring with the cap, and its tightening inclines for locking the cap when closed, the whole being constructed and operating, whereby the cap of the ventilator is not only made self-rising and held open by the spring beneath to insure ventilation whilst loading and discharging cargo, without loss of time or labor in opening or closing the ventilator as goods are passed on or over it and the deck, but whereby greater convenience and facility is afforded for rolling or passing casks of goods over the ventilator, by reason of the specified yield or easy depression which the cap is made capable of, when the cask in touching the cap throws part of its weight thereon, and whereby the ventilator is rendered less liable to strainage, injury, or breakage of its stem, or other part, when open, and is more securely locked when closed, and the cap protected from accidental turning or opening, by reason of the upward pressure of the spring causing the locking projection of the cap to bite firmly against the stationary inclines."

72. For an *Improvement in Machines for Hackling Corn Husks;* Wm. H. Fullerton, Louisville, Kentucky.

Claim.—"I claim the particular form of the teeth employed, of whatever material they are made, for the purpose of being arranged in any way, on drums or otherwise, and the particular application of them for the purpose of hackling corn husks."

73. For *Hot Air Furnace;* Peter Sweeny, Buffalo, New York.

Claim.—"I claim making such air supplying apparatus movable and adjustable within the fire-pot or chamber, for the purpose of adapting it to the varying height and condition of the charge of fuel to effect the economical combustion thereof. Also, making such air supplying apparatus in two parts, substantially as specified. And, finally, dividing the hot air chamber into two or more compartments, by partitions provided with apertures governed by dampers or valves, for the purpose of regulating the supply of air to separate the parts of a building, as circumstances may require."

74. For an *Improvement in Self-Acting Mules for Spinning;* George Wright, New England Village, Massachusetts.

Claim.—"I claim, 1st, Driving the carriage in and out by the continuous motion of the cone pulleys, in combination with some method of automatically shifting the belt, for the purpose of adapting the speed of the carriage to the requirements of the different parts of its traverse, by which means I am enabled to dispense with the complicated mechanism heretofore adopted for the attainment of the same end. 2d, The pulleys upon the shaft, by which a continuous motion in one direction is given to the shaft, for

the purpose of driving the carriage, and an intermittent motion to the twist pulley, when the winding on is accomplished by mechanism independent of the motion of the twist pulley. 3d, I claim the friction pulley, or its equivalent, constructed and operating in combination with any efficient method of regulating the speed of the spindles by the tension of the yarns, in the manner set forth, by which means I dispense with the complicated machinery heretofore made use of to regulate the winding on, and am enabled to run my machine at a speed far exceeding that which can be attained where the motions of heavy cogged gearing are to be constantly reversed."

75. For an *Improvement in Augers, Gimlets, &c.;* W. Spangler, Harper's Ferry, Va.

Claim.—"I claim constructing augers and gimlets out of any desired shape of metal, by filing, turning, or in any equivalent manner, or using tapering pieces of metal concave on one or both sides, and forming two bevel cutting edges, or graduated or regularly diminishing conical twists."

76. For an *Improvement in Apparatus for Corking Bottles;* Thomas W. Gillett, New Haven, Connecticut.

Claim.—"I claim combining the safety cylinder or screen with the cross bar of the charging socket, or other proper part of the bottling machine, so that the said screen will surround the bottle at the same time that the charging socket is brought over the neck of the bottle, and keep it there until the filling and corking has been completed."

77. For *Improved Adjustable Bearings for Circular Saws;* Ann G. V. McKinstry, Administratrix and Executrix of Wm. McKinstry, late of Washington, D. C.

Claim.—"I claim the arrangement of the bed plate carrying the boxes, in combination with the set screws, holding bolts, shaft, and circular saw, as set forth."

78. For an *Improvement in Fire Arms;* Eden Baldwin, 2d, Administrator of Eden Baldwin, Worcester, Massachusetts.

Claim.—"A movable loading or slide chamber, and a tubular loading magazine, in combination with the gun barrel, is not herein claimed; but what is claimed is, 1st, The manner in which such movable slide chamber and loading magazine are arranged, combined, and made to operate with respect to one another and the barrel, whereby a series of charges or cartridges are successfully carried from the magazine to the barrel by one sliding chamber only. 2d, And, in combination with the depressing chamber or slide, and the tubular or loading magazine, I claim mechanism substantially as described, for moving the cartridges into the depressing chamber when depressed into line with the loading magazine. 3d, And, in combination with the slide and the lever, and mechanism by which the cartridges are drawn towards the chamber of the slide, I claim the circular arc projections and the correspondingly curved recess, the same being for holding the block in place or at rest while the toothed sector is out of engagement with the rack, and the lever is in movement to actuate the rod, as described."

79. For an *Improvement in Sewing Machines;* George A. Leighton, Assignor to Nehemiah Hunt, Boston, Massachusetts.

Claim.—"I claim combining with the longitudinal movements of the two needles of the sewing machine, lateral movements of one needle, so that the forward and backward movements of each needle shall be respectively on opposite sides of the other, instead of on the same side of it, whereby the crossings of the loops are made to be drawn into or directly over the holes made through the cloth or material sewed, and so as to produce very flat seam or sewing."

80. For an *Improvement in Machines for Making Wire Heddle Eyes;* Thomas Clegg, Assignor to himself and Nathaniel Stevens, Andover, Massachusetts.

Claim.—"I claim the combination of pressure jaws or mechanism with machinery for doubling and producing the twist in the wire, the said pressure jaws or compressing mechanism being for the purpose of flattening the twists of the wire. And, in combination with the pressure jaws or mechanism, and the mechanism for producing, doubling, and twisting the wire blank, I claim the movable carriage, and its jaws or mechanical equivalents therefor. Also, the combination of the stationary rest and movable disk with the slider or bearer, the shaft, and the rotary notch gear."

MECHANICS, PHYSICS, AND CHEMISTRY.

For the Journal of the Franklin Institute.

Thoughts on the Caloric Engine. By Thomas Ewbank, Esq.

The substance of this paper was written a year ago, and withheld from the press lest it might be deemed a gratuitous interference with parties worthily striving to accomplish a great purpose. The "Caloric Engine" has now been so long before the public, that no remarks made on it can, in the slightest degree, affect it. It has become the subject of general—almost universal remark. No enemy, if it ever had one, can take from it aught belonging to it, nor fasten upon it defects from which it is free. Indeed, it is absurd to suppose discussion, or even bitter opposition, can at this day seriously injure, or injure at all, any project in mechanical science which appeals to actual experiment for proof of its worth. A truth in physics is as impregnable as a moral one, nor can the enthusiasm of the world in favor of an error successfully sustain it.

It is the *principle* of the engine that is here considered, not the mechanism at all, except so far as is requisite to elucidate the principle. Nor have the following remarks anything to do with the absolute mechanical equivalent of heat, which may, or may not, be greater or less than heretofore imagined. It may very well be that more power can be drawn out of heat when applied to air than has been obtained from its application to water; a result which, if attained, would simply show the equivalent to be greater than previously supposed, or that it varies with the media through which heat is employed.

The very bold and continued claims on behalf of the Caloric Engine have induced a disposition among some philosophers to give up the received theory of heat in relation to power, and to look out for another. To the practical man, speculations on heat, separate from ponderable agents it circulates in, are little more to the purpose than inquiries about the soul of a draft animal when estimating its strength or the work it performs. To him the "phenomena of latent heat," as regards liquids, are sufficiently accounted for by *diffusion*. A spoonful of syrup is less sweet when poured into a tumbler of water, still less in a gallon, and insensible or latent when diffused in larger quantities. Like heat in common air, or in a bar of iron, the syrup may, by concentration, be again collected. It suffices him to know, that heat is nature's grand expanding agent, and that nothing can be elastic without it; that every form of matter has its own share allotted to it, and when increased or diminished by external influences, the natural quantity is resumed when they are removed.

As regards the conversion of heat into mechanical action, it is now said that the work done is, in every case, proportional to the quantity lost, or destroyed, in the operation, and that whatever escapes, as in the puffs of steam from steam engines, has passed uselessly through them. Accordingly, it has been inferred that a low-pressure engine turns to account only 5 per cent., and a high-pressure one $2\frac{1}{2}$; that is, in the former, nineteen-twentieths of the power are wasted, and in the other, out of forty measures, all save one. Such is a recent French hypothesis. Those who have occasion repeatedly to load an engine to the verge of

its power, who observe how its pleasant movements become laborious strainings and its easy breathings prolonged groans, will hardly be persuaded that all the power above five or above fifty per cent. is then lost.

Supporters of this hypothesis differ from those of another, but their object is the same. With like feelings they direct their eyes to the hissing and roaring fluids rushing from waste pipes, like crowds of lusty laborers out of factory gates to play. It grieves them to see so much power dissipated. One party, thinking it has done no work, since it comes out so noisy and turbulent, proposes to give it enough to exhaust it; the other, beholding it so vigorous, thinks to send it back as often as it escapes until it breathes its last. Both, we apprehend, are mistaken. They resemble, to some extent, those who, having purchased goods and consumed them, wish for their money again, or for another supply without charge. There does not appear to us any sufficient reason or facts why a motive machine should be charged with imbecility or prodigal waste because it does not annihilate its motive element, nor yet why that element may not, after raising a piston, be discharged unscathed. The purpose is to use it, not to destroy it, and surely the heat of air and steam engines is no more annihilated than it is in the breath of animals, in air guns and sarbacans, in fire arms, digesters and common caldrons. In whatever machine it is employed, it finds its way (whether it do much work, or little, or none,) either through open channels or through the materials of its prison walls, into the atmosphere, the great and rapid equalizer of artificial temperatures.

Intricate reasonings on the principles and action of motive gas-engines will never be studied by the public, but there are salient points in them which the popular mind can perceive at a glance, and thence correctly infer the characteristic features of each.

Motion in them is caused by a change of volume which the motive fluid undergoes after being forced into a close chamber. It is there swelled by fire, and consequently requires more power to keep it in than was spent in putting it in prison; its increase of resistance being measured by its increased bulk, and the bulk depends on the heat it takes up. Had it undergone no change, the equilibrium of the machine would not have been disturbed, but now in its efforts to burst through the walls that confine it, the weakest part (the piston) gives way before it. After pushing this back, the object of its imprisonment, it is allowed to escape, when a fresh charge is introduced to drive back the piston to its former place, and the operation is repeated.

In these engines it is clearly desirable that the expanding agent should be presented in as compact or condensed a form as possible, since the resulting force depends on the quantity, not volume, of the matter dilated; hence solids and liquids give out more power than air, because its materials are already dilated into the gaseous state. Detonating compounds contain large volumes of gases. A pint of gunpowder gives out 250 gallons. A pint of water makes two hundred and twelve gallons of steam, while the same heat* that boils water would not swell a pint of air into a quart. Another striking mark between steam and air-engines, is, in the different dimensions of their feed-pumps. This is unavoidable, result-

* By this, it is presumed, the writer means not the same absolute heat, but the same sensible temperature.

ing, as it does, from the widely different densities of water and air. The feed-pump of a steam engine need not exceed *one-sixteenth-hundredth* of the capacity of the working cylinder; that of an air-pump is required to be *two-thirds*. The power abstracted by these from the effective force of their respective engines is in the same proportion. From the steam engine its feed-pump takes away only $\frac{1}{1600}$ of its power, while that of the air-engine abstracts no less than *sixty-six* per cent.

Thus, an air-engine can only transmit one-third of its power to any work to be done, while a steam engine gives out the whole, for the small amount withheld to work its pump is too trifling to be noticed in general results. We are therefore inclined to think, that air is too attenuated a body to supersede or successfully compete with steam by any further expansion that can practically be given to it.

But the efficiency or inefficiency of atmospheric air, as an agent for obtaining motive power from fire, would at this day have excited little attention had it not been connected with the surprising proposition that, by means of it, a mechanical force when once given out can be made to act a second, third, fourth, or fortieth time. This it is that marks the Caloric Engine as an extraordinary one—extraordinary for its claims—since, by no contrivance heretofore has the smallest amount of force been caused *to repeat itself*. We are constrained to believe it cannot, and that the idea is allied to those according to which power is ceaselessly to circulate through prime movers and the objects they move. Objections may be raised to references to the natural world, but we are very sure if the strange thing exists not in nature, it is opposed to nature, and exists not at all. Man makes not principles.

Several things are common to natural and artificial motors, but the gift of using the same power over and over is not among them; and yet, if man has the ability to impart it to insensible mechanism, it is strange that the Creator has not, in his benevolence, conferred it upon animals. From what an amount of suffering it would have saved them and us: the hungry, the weary, and aged, would never have drooped from exhaustion. A strong and sprightly horse goes to a day's labor, and returns weak and spiritless: his strength has gone out of him. How is he to recover it? Where is it? In the soil he has been ploughing? In the plaster he has been grinding? Or in the road he has been traveling? Be it where it may, it is never restored to him. A *fresh* amount may be produced in him, by means of food, and when it is gone, new nourishment brings in a new supply. Thus it is with all living, and so it is, we think, with artificial laborers. The power of the latter depends, as much as that of the former, on the food they consume. To revive their exhausted energies, they must be supplied with fresh meals. Withhold these, and their movements cease—so at least it has always appeared hitherto. But while both agree in this respect, they widely differ in another:—While one class, whether they work or not, are liable to perish of hunger, the others suffer nothing from prolonged fasting. They merely cease to stir till they are fed, and being insensible to pain and fatigue, are of greater endurance. Then, we can hasten the consumption of food in the stomachs of steam and air-engines, and keep them at work for indefinite periods, but not so with animals. There

is no working them for long periods without intermission—there is no cramming them, like the furnaces of boilers, nor applying blowers to hasten digestion: and if there were, we should be no nearer the object sought, since intervals of *rest* and *sleep* are indispensable to them.

It was ungenerous in the carrier who, without diminishing the labor of his team, reduced their fodder to the starving point; but attempts to extort a maximum of work from a minimum of food, did not begin with him. The Caloric Engine is allied to many, and the author contemplates a much greater saving than most of their contrivers hoped to effect. He proposes to get out of it, and while keeping it on remarkably short commons, not only as much work as the full-fed ones on board of steamers perform; but, by means of a "regenerator," it is to continue giving out power by swallowing over and over the essence of its spare and infrequent meals, the virtue of each swallow being deemed equal to that of a fresh meal. Whether inanimate, any more than living, prime movers can stand this, is a problem the Caloric Engine is to solve.

In every age, of which records have reached us, men have sought to leap over the boundaries that limit the range of their faculties, and the conditions imposed upon matter. Captivated by plausible suggestions, those of an inventive turn have mistaken illusions for realities, and have labored and reasoned to persuade the world they were right. Of these mockeries none have been more hotly pursued than an instrument which, as a consequence of the forms, proportions and arrangement of its parts, shall start into action, and continue to act till its materials wear out or its members fall asunder. To effect this, endless contrivances and modifications of contrivances have been tried, and, notwithstanding uniform and universal failure have marked all past and present efforts, there are still some, and even among the learned, who believe the thing possible; gentlemen who would certainly receive with incredulity the announcement of a similar creation in the animal kingdom. Of the two miracles, the one they hope to perform would be incomparably the greatest.

There are those who discard as absurd all attempts to gain power by wheels, springs, and levers, and yet imagine they can get it by fluids without giving anything like the usual price paid for it, and so specious have schemes on this plan appeared, that both experienced and inexperienced men have been led astray. As steam, for example, after raising a piston retains its properties and most of the power, or heat, it had in the boiler, it has been thought no difficult matter to withdraw it for a moment till the piston descends and then let it in again, instead of discharging and replacing it with a fresh supply from the boiler. Why, instead of a single exertion of its power, not compel it to urge the piston at least a few times to and fro before dismissing it screeching from service?

Of this class of inventors, Captain Ericsson is the most prominent now before the public. The principle on which his invention rests is, the repeated use of the same caloric. In his engine, as in the steam engine, *heat* is the animating principle, and in using over and over the same heat, he virtually and actually uses over the same power. He claims to have succeeded in seizing upwards of 90 per cent. of heat expended in raising a loaded piston, and in returning and compelling it to

do the same work over again; and that but for practical difficulties and imperfections attending the construction of a new class of machines, the *whole* heat might be saved from running to waste, and put at constant use. Captain E. is said thus to have reduced the consumption of fuel to an unheard of degree. Of this there can be no doubt, *if he is not mistaken.* Apply the same improvements to ocean steamers, and their boilers will be reduced to kitchen cauldrons and their furnaces to parlor grates.

The idea appears to have arisen (see further on), out of some undefined notions of the nature of heat, and that when united with a fluid medium it can somehow or other be used independently of the laws that control ponderable bodies.

Heat, or caloric—we use the terms synonymously—is a mystery, and so is Force. We know nothing of either except from its effects. It is only through bodies they act on that we can study them. In the Caloric Engine, heat is imparted to atmospheric air, and hence it is *air* that we have to deal with, and there is no more mystery about its mechanical action in that engine, than in a syringe or bellows. Additional heat communicated to it from the furnace, does not release it from any law to which it was previously subject; hence, when heat is employed as a motive power, it would make no difference if, in its nature, it were allied to the spiritual, since it comes under the same category, in the body that holds it, as any other power.

It was comparatively in late days, that the relation of heat to mechanical force was studied, and more recently, that their mutual equivalents were ascertained, or approximately ascertained; but, as will appear, the accepted doctrines in this branch of physics, are repudiated by Captain Ericsson. John P. Sargent, Esq., the solicitor for Captain E., in a Lecture before the Boston Lyceum, in 1844, on Ericsson's Inventions, [Wiley & Putnam, New York and London, 1844,] observes—

"The object of Ericsson's Caloric Engine, is the production of mechanical power by the agency of heat, at an expenditure of fuel so exceedingly small, that man will have an almost unlimited mechanical force at his command, in regions where fuel may now be said hardly to exist. The announcement of such an idea may startle all those acquainted with the nature of heat, and the well known limits of the amount of mechanical power which any given quantity of caloric is capable of producing; more particularly, as it is a well-established fact, that a given quantity of heat will exert an equal amount of mechanical power, to whatsoever medium it may be imparted.

"Ericsson's theory of heat is altogether in opposition to the received notion, that the mechanical force produced will bear a direct known proportion to the quantity of caloric generated. * * * * The basis of the Caloric Engine, is, that of returning the heat, at each stroke of the piston, and using it over and over again. * * * * This result Captain Ericsson has accomplished by means of an apparatus which he styles a *regenerator;* and so perfectly does it operate, that the heat employed in first setting the engine in motion, continues to sustain it in full working force, with no other renewal or addition than may be requisite to supply the inconsiderable loss by radiation."—Pages 51-55.

This is what Ericsson and his friends still claim, and assuredly if he can, by any device, regenerate an ounce of power, or if he can send half an ounce back to the working cylinder and make it do its work over and over again, he has done what man never did before him, and what the Creator has not, that we know of, done in any one of His motive machines.

The regenerator is an ingenious device, but not what its name implies. It is at best but an economizer of heat in the same sense and after much the same manner as contrivances by which waste steam of engines imparts heat to cold water supplies, and it is yet to be proved, that in either case, *any* heat is absolutely saved, except it be from a surplus admitted into cylinders over that required to move the pistons; and even then, whether what is arrested and returned to the receiver or boiler, be not procured at an expense equal to its value. We worked a stationary high-pressure engine for years; the steam, after doing its work, was conveyed into a wide and shallow box in which two or three fathoms of the feed pipe (between the pump and boiler) was coiled. The cold water ere it entered the boiler, was thus raised to about 160° F. That this additional temperature derived from the waste steam was a clear gain, was never imagined. The additional power consumed in driving the water through the coiled tube, and the increased retardation of the steam's exit from the cylinder in consequence of its diversion through the box, were clearly paid for it, if nothing more. So with the regenerator; its meshes of wire perform the part of the coiled pipe, but more perfectly because they mix directly and more intimately with the fluid to be heated; still, in proportion as they do this, they retard the air's passage through them. If it oozed through layers of finely granulated metal—fine as that used in place of sand in ships' hour-glasses—it would give out and take up heat still more readily, but then its passage would be more obstructed than by the metallic gauze, and more power would be expended in driving it through.

The idea of extracting more out of a force than is in it, will probably never be obsolete. It presents itself in such diverse and pleasing forms, that parties will always be found to cherish it. Appearing in the mien, garb, and winning simplicity of truth, the illusion is singularly successful in the tenacious faith of its votaries. Vanishing under investigation, it re-appears as soon as that is over, and, in nine cases out of ten, is more warmly received than before its character was questioned.

Every one knows that it takes some power to lift a load from the ground, and that it must be more than equivalent to the load, since, if merely equal, the two would be balanced, like equal weights in a pair of scales: one could not overcome the other. Then no one is ignorant, that if the load be dropped again, it cannot be lifted a second or third time with less power than was required for its first elevation: in other words, that it does not grow lighter by falling, nor the power stronger by lifting it. This is manifest, and yet attempts to "gain power," whatever may be the materials and devices employed, are virtually efforts to lighten the load, or to raise it with less than its equivalent of power.

It may not be agreeable to believers in the alleged powers of the Caloric Engine to have it associated with attempts at perpetual motion, but if the claims respecting the virtue of the regenerator are just—if by it the same power is actually used over and over—the old popular fallacy is, or is about to be, a great modern truth, and the greatest of all mechanical truths; for by it power barely sufficient to forge a nail, may, in time, be kept going till it fabricates tons, and heat that once drives a vessel over the Atlantic or locomotive over a railroad, will suffice to propel them to and

fro for an indefinite number of trips. Losses by leakage, radiation, &c., be it remembered, affect not the *principle*. They are incidental difficulties that may be overcome. What, then, if the principle affirmed *be* true, is there to prevent power expended in sawing a plank, making a shoe, weaving a carpet, ploughing fields, &c., from going on producing and ploughing; or the labor expended on the erection of a house, from building a city, or when a mile of railroad is once made, from the same power continuing it round the globe.

Captain E., it may be said, dreams of no such things. Suppose he does not: it is not the less true that these are natural and unavoidable deductions from his proposition. It is the principle that is in question. Establish the fact that mechanical force *can* be made to repeat itself, and no matter to what extent—large or little—Captain E. or any one else has carried, or may carry, it out. But Captain E. and his friends do contemplate the performances of miracles akin to those named: they expressly assert of the Caloric Engine, "its object is the production of a continued force almost without reference to the amount of the original exciting cause." (Sargent, p. 60.) The "almost" being inserted to meet small deductions arising from practical imperfections. M. Foucault, the celebrated inventor of the Pendulum experiment, for rendering the rotation of the earth visible, thinks the Caloric Engine "has conquered a great principle," and that it "all but leads to the conviction that the perpetual motion is at last discovered."

The repeated or continued use of the same power is the essence of the perpetual motion; and while not one seeker has found it, every one thinks he has got nearer to it according to the per centage of power he has gained, or, in other words, "used over and over." Now the fact is, that *any* portion, large or small, thus gained, is equal to gaining the whole. When 90 per cent. of power is used, say only *once* over, 180 will have been got out of 100. And if one or one-tenth of one per cent. be "used over and over again," the same miraculous result follows—a part will be found greater than the whole—and infinitely greater, too.

But, as we observed, there is no making pounds out of pennies in the currency of force: capital in it carries no interest—neither simple nor compound.

(To be Continued.)

For the Journal of the Franklin Institute.

An apparatus for Organic Analysis by Illuminating Gas, and on the use of this Gas in Experimental Laboratories. By Charles M. Wetherill, Ph. D., M. D.

(Continued from page 115.)

The parts of the Apparatus separate from the Combustion Tube.

These consist of the stands for holding the drying and absorption apparatus, and conveniences for passing the oxygen and air during the combustion. I think gas bags of vulcanized caoutchouc are preferable to the use of Pepy's gasometer, as the inconvenience of the use of water is avoided and space is economized. Two of these are used, of a size large enough to hold gas for five or six analysis, and are placed under

the table, pressed each between two boards united by a hinge. They can be loaded with weights just sufficient to give the requisite pressure to the gas contained in them, which enables the current to be kept under better control, and the pressure remains pretty constant during the analysis which contributes to the same result. The gas passes up through the table by means of india rubber tubes connecting with gallows screws to the apparatus. In preparing oxygen from the chlorate of potassa of commerce, the gas is contaminated by certain compounds of chlorine which would interfere with the accuracy of the analysis. These may be removed by passing the gas through a solution of caustic potassa; but as the oxygen by the method of preparation in use comes off with great rapidity, there is danger of it being insufficiently washed. I have obviated this by a peculiar construction of the end of the tube which delivers the gas into the washing fluid. The end of this tube is drawn out to afford a handle, and sealed: a bulb is then blown, and during the process, drawn out oblong by means of the handle, which is then cut off closely. Of course, it must be made of diameter to slip readily into one of the necks of the Woulfe's bottle. Three or four zones of fine holes are then made close together, and to each other, around the bulb, which, as the glass is thin, is best effected by heating the platinum wire (instead of the glass) close to the bulb, and pushing it through, and quickly drawing it out after removing it a short distance from the flame. After cutting off with a file the little tails thus formed, the edges may be smoothed in the flame. It is plain, that with such a tube dipping into the washing bottle, the gas will be separated into a great many streams, which dash on all sides through the liquid; when the pressure is moderate, the upper zone alone will permit the escape of the gas, but with increase of pressure the lower zones will come into action, and the greater the pressure the more the gas will be divided, and consequently the more effectually washed. This form of wash bottle would be useful for a great many purposes of absorption in the laboratory. When the oxygen current is at its greatest degree of rapidity I have not observed any of the liquid to be carried over, though it is violently agitated and stirred in all directions. As it is easy to dry the gas at the same time, it passes from the potash solution into a wash bottle exactly like the former, containing oil of vitriol; it thus enters the gas bag perfectly dry, and deprived of chlorine compounds as well as of any carbonic acid resulting from impurities in the chlorate of potash. The air is pumped into its appropriate bag by the table blow pipe, the air duct of which is connected with the same washing apparatus described above. Though the oxygen and air have been thus purified and dried, for precaution's sake, as well as to be able to watch the gas current at this end of the apparatus, it passes through oil of vitriol in a Liebig's potash apparatus, and through sticks of caustic potash in U tubes; these are suspended upon a stand, on the extremity of which are situated the cocks for controlling the kind and supply of gas to be passed through the combustion tubes, and which are represented in end view at fig. 7,* Plate III. It is an advantage, especially in the case of double combustions, to be able to pass either air or oxygen independently of each other, to the two combustion tubes, and without the need of connecting or disconnecting the

* Scale $\frac{1}{4}$.

drying apparatus, and at the same time to effect this with but two gas bags, one for the air and one for the oxygen. This end is obtained by the two three-way cocks, represented in section at the bottom of the stand, fig. 7, and the tubes connecting, which are, for the greater perspicuity, represented out of their natural position. Each of these cocks has an opening into which the vertical tube *a* is soldered, and two lateral openings. The two interior lateral openings *e e′*, are connected with a tube having an exit *b*, on which is fixed the gallows screw, connecting by india rubber hose with one of the gas bags, say the air one. The outside openings of the cocks are connected with another tube bending around them and opening at *b′* into the connexion with the oxygen bag. In natural position, these tubes are fastened firmly to the bottom of the stand, and the gallows screws stand vertically. The plugs of the cocks have only two openings, and the handles which operate them are placed in their angles of intersection as seen at *g* and *g′*. It is plain, that when this handle is placed vertically, all the holes are closed; when turned to the right, a connexion is made between the vertical tube *a* and that to which the handle inclines; when turned to the left, it connects the other tube with the tube *a*. In the drawing, *g* is placed so as to connect *a* with *e*, opening into *b*, or passing air through the combustion tube. In the other cock, *g′* is placed so as to connect *a′* with *d′* and *b′*, or in this case so as to pass oxygen. By means of small tubes of caoutchouc *a* and *a′* are connected with the drying apparatus suspended on the stand. This is constructed with two upright supports, into which rods slide that may be kept in position by binding screws. The tops of these rods are connected by a piece of thick sheet brass, about an inch wide and in a horizontal plane; upon this brass are placed the clamps represented at *c*. These clamps may be fixed in any position on the brass plate, and by their means and by the sliding rods the connexions with the combustion tubes may be adjusted in their proper positions. There is another stand like fig. 7, without the cocks and somewhat longer, for holding the chloride of calcium tube and potash apparatus. It is important to give the potash apparatus an inclined position; this is effected by giving one turn around the two sliding rods *f*, with a thin copper wire united at the ends; a piece of wood of the proper length is placed so as to keep apart the two wires running parallel between the sliding rods. By advancing this wood towards the two potash bulbs, the requisite inclination may be given to them, and as it is better to have the larger bulb of the potash apparatus situated where the gases of combustion leave it, it will be best to have the tubes of the potash bulbs so bent that one apparatus can be used on one side of the stand, and the other on the opposite; the piece of wood above mentioned will then, by keeping the two apparatus apart, give them the proper position. The tubes rest in the forks of the clamps, two clamps being necessary for each piece of apparatus.

Mode of Performing the Analysis.

The combustion tubes being filled (so as to leave a passage of half the diameter of the tube) with oxide of copper to near the part heated by the gridiron burners and kept in position by plugs of asbestos, and the small cocks of A, (fig. 1,) being all open, the gas is lighted and the tubes raised

to a red heat, the handles of the cocks g g' (fig. 7) being placed so as to pass a slow current of air. When the oxide of copper has been thus dried, small chloride of calcium tubes are placed in the ends of the combustion tubes, and the current of air being stopped, the gas is shut off. While the tubes are cooling the different parts of the apparatus for the absorption of the products of combustion are weighed, and also the platinum trays containing the substance to be analyzed. When these have been placed in position, the small cocks at A, fig. 1, and the large cock feeding them, are shut off, and the front and back parts of the combustion tubes raised to a red heat, after which the combustion of the substance is effected at A, fig. 1, by gradually advancing the heat from end to end in the manner indicated in a former part of the article. At this stage of the combustion, if it is not possible from danger of explosion to pass oxygen, a slow current of air is passed instead. At the close of the operation, a coaly residue remains in the platinum trays, which is burned off by passing oxygen, which is continued to be passed until it comes out at the end of the U tube containing solid potassa, which is attached to the potash bulbs. The handles of the three-way cocks are then reversed so as to pass air, which is continued until it replaces all of the oxygen. The chloride of calcium and potash apparatus and platinum trays are now weighed, and every thing is ready if required for a second double analysis.

The cost of gas for an analysis as ascertained from the metre during a double combustion, is two and a half cents, the gas costing at the rate of two dollars per thousand cubic feet.

Experiments with the Apparatus.

Before proceeding to analysis with the apparatus, experiments were made to test its freedom from sources of error, but, first of all, with regard to the change of weight which has long been observed to take place in the chloride of calcium tube and potash apparatus. This has been attributed to a change of hygrometric state by the heat during the combustion, and it has been, therefore, recommended to wait a half of an hour after the combustion before making the final weighing. Regnault has advised the use of a similar apparatus on the other scale for a counterpoise to counterbalance this error.

To ascertain the circumstances of this change of weight, the chloride of calcium tube and potash apparatus cleaned and prepared for analysis, were repeatedly weighed at intervals during a day, being careful to touch them only with intervention of a piece of paper, and keeping, in the intervals, the ends of their tubes closed with little caps of caoutchouc. During the intervals of weighing, they stood sometimes quite close to the balance (near which hung a Mason hygrometer) and never at a greater distance than four feet, which did not seem to alter their behaviour. The balance (one of Oertling's latest) has been long proved as to its delicacy and accuracy; the beam divided decimally, enables half milligrammes to be weighed by a rider, and having further divided the beam accurately with a pair of dividers and having suspended a lens in front of the index needle, I can weigh with confidence to quarter milligrammes and even (though not so surely) to tenths. While I have for the past few years

observed a variation in the weight of glass apparatus, the various platinum vessels in use have maintained their weight with a surprising constancy; one small crucible used for incinerations having lost during four years, only one-half a milligramme, and yielding the same weight without fluctuations, no matter how often it is successively weighed.

The following table indicates the result of consecutive weighings of the potash apparatus. Column A shows the intervals of the successive weighings, and B the difference from the preceding weighings in milligrammes and quarters, + denoting an increase, — a loss, and 0 no change; C indicates the difference between the different weighings and the original weight.

A	B Milligrammes and fractions of the same. Difference from preceding weight.	C Difference from original weight.
Original weight 60·5955 grammes.		
5 minutes after the preceding, .	0	0
33 " " " " .	+0·75	+0·75
25 " " " " .	0	+0·75
35 " " " " .	—0·50	+0·25
1 hour 40 minutes after the preceding,	+0·25	+0·50
1 " 29 " " "	—1·00	—0·50
2 " 6 " " "	0	—0·50
17 " 0 " " "	+0·50	0

From C it appears that in 24 hours the potash apparatus had attained its original weight, though varying constantly in the interval, as seen from B, and without any apparent law. The dew point observed by a Mason's hygrometer in the neighborhood of the balance did not vary (during the day-time when observed) by an appreciable quantity. The greatest variation between the successive weighings was one milligramme.

In the following table, for the variations of the Ca. Cl. tube, the letters indicate the same things as in the preceding table.

A	B Milligrammes and their fractions. Difference from preceding weight.	C Difference from original weight.
Original weight 40·55975 grammes.		
17 minutes after preceding, .	+1·75	+1·75
40 " " " .	—1·00	+0·75
18 " " " .	0	+0·75
1 hour 57 minutes after preceding,	—80	—0·05
1 " 16 " " "	+80	+0·75
1 " 17 " " "	0	+0·75

The next morning, the Ca. Cl. tube differed +1·50 milligrammes from the preceding, and + 2·25 from the original weighings, doubtless owing in a great measure to absorption of water by the chloride of calcium.

It appears from the above results, that the error of analysis from this source, and which is no doubt generally compensated in the two weighings, varies from one to one and three-quarters of a milligramme; this

error, with the quantity of organic substance usually taken for analysis, falls in the hundredths of the per centage calculation.

The following are the results of combustion without organic substance, to prove the working of the apparatus.

The Ca. Cl. apparatus was first connected to the caoutchouc tube which delivers air or oxygen to the combustion tube; to the Ca. Cl. apparatus was connected the potash apparatus, together with its accompanying U tubes, filled with caustic potash and weighed with it.

After passing oxygen for an hour and a half, in a moderately rapid current, the Ca. Cl. tube had gained $3\frac{1}{4}$, and the potash apparatus, $4\frac{1}{4}$ milligrammes. After passing a current of air for fifteen minutes, the Ca. Cl. apparatus returned to its original weight, while the potash apparatus indicated a loss of $\frac{1}{2}$ a milligramme. Passing air for an hour and a half longer, the chloride of calcium tube gained a quarter of a milligramme, and the potash apparatus experienced a further loss of one milligramme.

From this it follows, making the allowance for error in weight and a slight loss from evaporaton in the potash apparatus, greater than would occur in actual analysis, that the air and oxygen prepared by the method described in a former part of this article, are free from any cause of error for the analysis.

The apparatus were then attached to the combustion tube, as for an actual analysis, after having ignited the oxide of copper in oxygen and suffered it to cool in the air current, the corks were coated carefully with tin foil, and not dried. The combustion, (without substance,) was then proceeded with, passing oxygen for forty, and air for twenty-five minutes.

The chloride of calcium tube, weighed immediately after, had gained $6\frac{3}{4}$ milligrammes, and forty minutes later, two additional milligrammes; while the potash apparatus, immediately after, showed an increase of two milligrammes, and forty minutes later, returned to exactly its original weight.

A second experiment, under the same conditions as the last, and with fresh corks, gave a gain to the chloride of calcium tube, of $11\frac{3}{4}$ milligrammes, and three-quarters of an hour later, a further gain of $\frac{3}{4}$ milligramme. The potash apparatus, weighed immediately after the combustion, indicated a loss of two milligrammes, and $\frac{3}{4}$ of an hour later, returned to within $\frac{1}{4}$ of a milligramme of its original weight.

A third experiment with fresh corks, gave a gain of $5\frac{3}{4}$ milligrammes, and weighed an hour later, an additional milligramme, to the Ca. Cl. tube; the potash apparatus indicated no change of weight, immediately after the combustion, but an hour afterwards, had gained $\frac{3}{4}$ of a milligramme. It follows from these experiments, that coating the corks of the combustion tube with tin foil, as proposed by Marchand, does not prevent their giving up water to the Ca. Cl. tube; but if the cork be dried, as indicated by Liebig, accurate results are obtained without any tin foil coating, as the following experiment shows, in which the corks were kept over night in the Thermostat, at a temperature of 130° Centigrade.

The Ca. Cl. tube experienced a gain of only $1\frac{3}{4}$ milligrammes, and the potash apparatus one of $\frac{1}{4}$ milligramme.

A gain of 9 milligrammes of water, is equal for 400 milligrammes of substance to an excess of 0·25 per cent. of hydrogen.

The following analyses of sugar, were made from sugar candy, powdered, and kept for some time in the Thermostat, at a temperature of 100 Centigrade. The per centage of ash in this sugar, as determined by weighing the platinum dish after the analysis, was 0·09 per cent.; this was subtracted from the original amount of substance, in calculating the results. By theory, the sugar should give a per centage of 42·10 carbon, and 6·43 hydrogen. The first three analyses made with the apparatus gave—

Carbon, = 41·74; 41·51; 41·91.
Hydrogen, = 6·56; 6·70; 6·76.

The combustion tube contained oxide of copper in front, and behind the platinum tray was a plug of copper wire oxidized on its surface and about three inches in length. This latter was found disadvantageous, in rendering the tray dirty, and thereby interfering with weighing the ash, and besides seems to be of no use, if the gas current inside the tube be properly regulated. In the last two of the above analyses, which were made together, as a double combustion, the state of the metre was observed, and from beginning to end, (for the double combustion,) somewhat less than 25 cubic feet of gas were used, which at the present rates, gives a cost of about $2\frac{1}{2}$ cents, for a single combustion.

I endeavored to substitute for the oxide of copper, a porous mass, made by forming spirals of thin copper wire, around a knitting needle, and packing them in the combustion tube. The surfaces were oxidized by heating in a current of oxygen, and it was supposed that by thus increasing the oxidizing surface, a much shorter portion of tube in front of the platinum tray would be required; but the results turned out entirely bad; these analyses of the same sugar, gave—

Carbon, 38·89; 40·09; 39·54.
Hydrogen, 6·17; 6·26; 6·15.

Independently of these bad results, in case of breaking the combustion tube, it was difficult to extract these spirals without unrolling them on account of their rough surfaces adhering to the tube.

The following analyses of sugar were made with oxide of copper in the front part of the combustion tube; but without anything behind the platinum tray. The ash was not taken into calculation.

Carbon, 41·46; 41·89; 41·83.
Hydrogen, 6·51; 6·62; 6·56.

In none of the preceding analyses were the corks dried, but enveloped with tin foil, according to Marchand's suggestion, which was afterwards found to be ineffectual. The hydrogen, therefore, is somewhat too high from this source. The following analyses were made upon the fat of human adipocire, crystallized several times from hot alcohol, but not treated according to Heintz's process; the fat was tinged slightly yellowish and left no appreciable ash.

Carbon, 74·16; 74·63; 74·00; 74·70.
Hydrogen, 12·66; 12·76; 12·57; 12·47.

Analyses of fatty bodies require the greatest care in their performance, and the first stage of the combustion must be performed in an air current,

as oxygen gives rise to explosions in the combustion tube. Several analyses were lost in this way. Of the above results, the first was made with oxygen, and was the only one which succeeded; in all the rest air was used.

(To be Continued.)

Translated for the Journal of the Franklin Institute.

On a new System of Gearing for Machinery. By M. Minotto.

[Report of a Committee of the Society for the Encouragement of National Industry, Paris.]

M. Minotto, Vice-Director of Telegraphs in Piedmont, presented to the Society models and a description of a new system of gearing, called *wedge-gearing*, which is proposed to replace, in a number of cases, the common toothed wheels.

The complete study which he has made of this interesting question, deserves the attention of the Society: for the invention of a new mechanical element, having special properties, is no mean advance; it is an additional means of new progress.

Every body knows the properties of the wedge to multiply upon its lateral faces the force applied upon its back in proportion to the angle, so that in an isosceles wedge, the force exerted on either face is to the force applied on the back, as the height of the wedge to one-half of its breadth. Upon this property M. Minotto depends to increase the adhesion of wheels, without increasing the pressure on their axes in the same proportion. Thus, if it be required to drive two parallel axes by the contact of two pulleys mounted upon them, we know that it is necessary to press strongly in order to prevent slipping, whenever the forces to be transmitted are at all powerful, and in consequence to cause considerable friction on the axes. The same thing will not take place if a groove be

Fig. 1

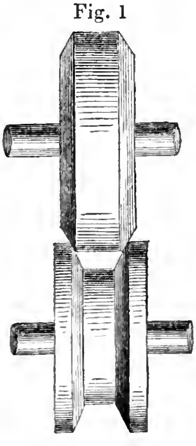
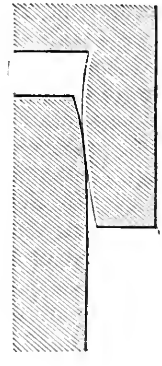


Fig. 2.



turned on the outer face of one of the pulleys, and the face of the other be of conical form, so that it may enter partially in the groove of the former, (Fig. 1.) All the properties of the wedge re-appear here; that is to say, in consequence of the greater or less acuteness of the angle of the

groove and its corresponding projection on the other wheel, the section of which presents a truncated cone, a small pressure on the axis may cause a very great pressure at the contact, and thus an adherence, by means of which one wheel will drive the other, overcoming the resistance which opposes its motion.

This is the principle of the system—let us endeavor to explain the advantages of its use.

Of the Slipping.—The most remarkable character of this system of gearing is, that a slipping may take place from a change in the forces. This property, which renders it improper to replace toothed wheels in systems where these are intended to assure certain rates of motion, as in horological apparatus, makes it, on the contrary, extremely valuable for applications where the resistance may undergo considerable changes, which is a continued cause of fracture of toothed wheels. This resemblance with the system known under the name of *friction-cones*, ought to be carefully observed, and constitutes an important property of the new system.

Of the Friction.—It seems that the sliding friction which is exerted on the faces in contact, especially beyond the primitive circumferences, ought to be a cause of inferiority of this system; but it is to be remarked that, in the momentary rubbing of the surfaces of contact around the mean point which defines the primitive circumferences, the parts further from this point wear out much faster than those which only roll, and, consequently, the face of the wedge has a disposition to take a convex form, which tends to reduce very much the value of the friction, (Fig. 2.) According to the calculation, the new system will offer a notable superiority over the toothed gearing, whenever the angle at the apex of the wedge is below 20°. Moreover, the inventor demonstrates that greasing, which much diminishes the friction, has but little influence upon the adhesion of contact, which is explained by the almost complete expulsion of the lubric at the point at which the greatest pressure is exerted.

Of the Wear.—The rapidity of wear in this system of gearing, and, consequently, the necessity of a gradual approximation of the axes so as to always proportion the pressure and adhesion to the resistance to be surmounted, appear to be the most prominent obstacles to the adoption of this system for large machines, although this approximation is often easy to obtain. As to the wear itself, although the author has made experiments which lead him to believe that it is very slight, yet it appears to us to be the weak point of the system, whenever it is not possible to multiply the number of wheels placed upon the two axes, which the lathe permits to be easily executed. So that, as the pressure on each point of contact may be always much less than that at which the destruction of the metal is rapid, this system may be employed for a long time, provided the axes can, from time to time, be brought nearer, and the conical groove be deep enough to work with a considerable wear.

We will enumerate here the arrangements contrived by M. Minotto to avoid and remedy the wear: first, the greasing to avoid jamming; secondly, the use of disks forming the wheels when united by means of bolts, wheels whose thicknesses may be varied by changing the block interposed between the disks.

Applications.—The system of wedge-gearing may produce not only motions of rotation, but also rectilinear motions by arrangements analogous to racks, cams, &c. M. Minotto proposes two applications, the one to rectilinear, the other to rotary motions, which we will here indicate:

One of these applications relates to railroads, and consists in the use of a grooved wheel, gearing upon a bar of iron placed in the middle of the track to increase the adhesion of locomotives in the ascent of high grades. The other employment which M. Minotto recommends, consists in the employment of the wedge-gearing for the transmission of the rotary motion to the large main axes of propeller steamships, which must move rapidly to operate usefully upon the liquid.

We only announce these two applications, which have not been put in practice and studied in detail, but which possess interest.

Signed, CH. LABOULAYE, *Reporter.*

For the Journal of the Franklin Institute.

An Account of some Comparative Experiments made at the Washington, D. C., Navy Yard, April, 1854, *on the ordinary mode of setting Land Boilers, and on the mode patented by* HENRY F. BAKER. By B. F. ISHERWOOD, Chief Eng., U. S. Navy.

The following detail of some comparative experiments made at the Washington Navy Yard, with the "ordinary" mode of setting cylindrical land boilers, and with the mode patented by Henry F. Baker, are of considerable value to mechanical engineers, both as regards the positive results obtained, and as definitively exploding a false theory. The "ordinary mode," shown in Fig. 1 of the diagram acompanying this article, is so well understood as not to require description: Mr Baker's method, shown in Fig. 2, is described in the following "claim," forming his patent, dated May 30, 1846, viz.

"What I claim and desire to secure by Letters Patent, is one or more reverberating chambers (made and arranged as above set forth) in combination with the fire-place and boiler, the same being made to revolve and retain the volatile products underneath the boiler, long enough to be consumed thereunder, as above explained; and I also claim, the manner of arranging the air distributing boxes with respect to the bottom of the boiler in combination with the curved deflecting bottoms of their respective chambers, in order that the flame produced by combustion of the volatile gases, or other matters, passing over the perforated plates of said air boxes, may be blown in jets against the bottom of the boiler as set forth; the said mode of arranging the said air boxes consisting in giving each of them an inclined position substantially as represented in the drawings and as above specified."

In the above claim, the object to be attained by the reverberating arches or chambers, is "to revolve and retain the volatile products underneath the boiler long enough to be consumed;" and in the pamphlet published by Mr. Amory, the General Agent of this patent, he says, "the improvement with Baker's furnaces is to be accounted for by the *more*

perfect combustion of the gaseous products of the fuel, which by the reverberations are retained longer and brought more intimately in contact with the atmosphere, thereby *converting much carbonic oxide* (which in ordinary furnaces escapes into the chimney) into carbonic acid, and occasioning a great saving of caloric."

Now, according to the above, Mr. Baker's arrangement is an attempt to remedy a defect which does not exist, as nothing connected with steam boilers is better determined than that with the ordinary proportions of practice, and even with proportions differing extremely from them, no carbonic oxide is formed in the flues; this has been the unvariable result of a considerable number of chemical analyses of the products of combustion in the flues and chimneys of steam boilers. The only manner in which carbonic oxide can be formed, is by deficiency of atmospheric air to furnish the necessary quantity of oxygen to completely oxidize the carbon and hydrogen of the fuel; but the ordinary proportions of practice is found to furnish about *twice* as much atmospheric air as is required for perfect combustion; consequently, so far from carbonic oxide existing in the flues, there is always found in them a large quantity (about ten per centum) of free or uncombined oxygen.

Supposing, however, that carbonic oxide did exist in flues, it could not be converted into carbonic acid, by the manner proposed by Mr. Baker, which is by presenting to it a further supply of oxygen from the atmospheric air admitted at the bottom of his arches through the perforated plate; but cold atmospheric air presented to carbonic oxide at the moderate temperature of the flues, will not saturate it with oxygen in the short time they remain together in the boiler; consequently the only effect of these perforated plates will be the injurious one of cooling the boiler by the amount of cold air admitted.

This effect seems to have been observed by the Patentee, as the "perforated plates" are omitted in the arrangement of the chambers beneath the experimental boiler at the Washington Navy Yard, and a new feature is introduced *not patented*; viz., the front of the ash pits is closed, and the air for combustion is delivered beneath the grates through a pipe which first traverses beneath the inverted arches through a space filled with the heated gases of combustion, so as to supply the fuel with heated atmospheric air. This arrangement is as erroneous as the other, for it has been abundantly proven by careful experiments that no advantage is derived from the use of heated atmospheric air, because a given bulk of such air contains, on account of its greater rarefaction, less oxygen than the same bulk of colder air; consequently, the less amount of caloric required to raise the temperature of the heated air to that of the furnace, is compensated by the greater amount of such air required for the combustion of equal amounts of fuel.

Again, as far as regards the "revolving and retaining" of the heated gases by means of the arches, it is quite certain these gases will not be at all *revolved* or *retained*, but instead of following the shading in Fig. 2 representing their course, according to Mr. Baker, they will follow in a straight line, taking the shortest and most direct route from furnace to chimney, and leaving the arches beneath the dotted line, Fig. 2, filled

with quiescent gases. In a word, the reverberating chambers of Mr. Baker do not reverberate, and cannot, as arranged, be made to do so.

Could these chambers be made to readily do their supposed office, that is, retain, revolve, and mix up the gases in the flues, they would be highly beneficial, but not for the reason supposed by Mr. Baker, which is the conversion of carbonic oxide into carbonic acid; but for the following reasons, viz. When a mass of heated gases passes through or beneath water (as in the case of steam boilers) only a thin film of its periphery or envelope can be in contact with the water, consequently, the heat can be extracted (which is quickly done) from this film only, leaving the heat of the central portions of the mass unextracted, until by their less specific gravity, the result entirely of their higher temperature, they rise, displace the already cooled film, and present another film, from which the heat is in turn extracted, when it obeys the same law and sinks, its place being supplied by still another film, and so on. This is the only mode in which the caloric of the mass of hot gases can be extracted, and this mode is due solely to the action of gravity; were there sufficient *time* allowed, the gases being retained in contact with the water, their heat would undoubtedly be thus extracted down to the temperature of the water; but *time* is the very element impossible to be obtained; the gases in the flues of boilers are constantly flowing on to the chimney with considerable rapidity, even with the slowest combustion, not only rendering the interval of time elapsing from their leaving the furnace to their arriving at the chimney very short, even in the longest boilers, but neutralizing the action of gravity among their particles by the momentum imparted to them by the speed of the current or draft. Hence, with a thick mass of hot gases, or a mass having considerable area of cross section, a great waste of caloric results from the interior gases going into the chimney at a high temperature, but by making the mass thin, this effect is decreased and a greater amount of heat extracted. Now, could any plan be arranged of *beating up* the gases in the flues, or, in other words, of mechanically mixing them rapidly together, it is plain the temperature of the whole gaseous mass would be kept about uniform, instead of being of nearly the initial temperature in the interior and comparatively cool at the periphery. The arches of Mr. Baker will not perform this office, and therefore are useless, a conclusion fully borne out by the unexceptionable experiments made at the Navy Yard and hereafter described.

I have frequently thought that in the ordinary horizontal flues a tolerably complete *beating up* or mixing of the gases might be effected by *obstruction*, that is, by arranging in the flues, at short distances apart, flat iron plates or bricks, against which the flowing mass of the gases would strike and break like water against a board held in a rapid current, and then by eddying around behind produce a mixing up. The flues should of course, have a sufficient cross-section to admit these obstructions and retain draft enough for consuming the requisite amount of fuel. The obstructions should also be so arranged as to admit of their easy withdrawal for sweeping the flues, &c.

By the arrangement of the heating surfaces of steam boilers in vertical tubes, these tubes containing the water and standing in the mass of moving, heated gases which surrounds them, as in the boilers of the Collins'

line of steamships, the breaking up and mixing of the gases are very completely attained, the tubes themselves acting very efficiently as *obstructions;* and to this cause alone, I ascribe the very great superiority of this type of boiler, which, when properly proportioned, gives, incontestibly, under the ordinary conditions of practice, the maximum possible economical evaporation, and far exceeds, in that respect, any results possible from the other types in use.

The results of the comparative experiments hereinafter given, and made by Engineer-in-Chief, D. B. Martin, at the Washington Navy Yard, differ so vastly from the results of other experiments made by different persons and published by Mr. Amory, the General Agent of Baker's Patent *Setting*, that a brief review of these latter is necessary. In the experiments published by Mr. Amory, we are at once struck by the very large evaporation, considering the type and proportions of the boilers used, stated to have been obtained both by the Baker and the ordinary mode of setting. With a view, therefore, to obtain a precise limit in this direction, it is necessary to determine the *total theoretical evaporation* of the coal; that is to say, to determine the number of pounds of water which can be evaporated by one pound of coal, supposing its combustion to be perfect, and all the heat generated by that combustion to be imparted to the water, none being lost by radiation or by passing off in heated gas to produce a draft, or in any other manner whatever. It is evident that such a limit exists, and that this limit is the total theoretical evaporation by the coal.

The organic combustibles, coal, peat, lignite, and wood, are composed of carbon, hydrogen, and oxygen, earthy and other matter being merely mechanically or accidentally mingled. The hydrogen and oxygen produce during the combustion no heating effect when they exist in the proportion necessary to form water, because in the decomposition of water as much heat is absorbed as is disengaged in its formation; hence results, that the heating power of any coal is in the proportion of the carbon it contains, and of the excess of its hydrogen over the quantity required to form water with the oxygen. But this excess of hydrogen when it exists in coal at all, exists in the solid state, and as it volatilizes at a low temperature it must be consumed in the furnace in the state of gas: by the very process of volatilization heat is absorbed or rendered latent, and though no determination has ever been made of how much of the heat generated by the combustion of this hydrogen is required for its conversion from a solid state into gas, yet the amount is so considerable that taken in connexion with the very small per centage of *excess* of hydrogen existing in any coal, its effect may be considered insensible and practically neglected; as may also the effect of the very minute amount of mineral combustibles, sulphur chiefly, occasionally found mingled with the coal. From the foregoing it follows, that *practically the heating power of coal is simply in the proportion of the carbon it contains:* this being the case, it is necessary for our purpose to ascertain the total theoretical calorific power of carbon, which has been done by the following two authorities, viz.

Despretz determined that 1·00 units of weight of carbon is capable of heating 78·15 units of weight of water, from the freezing to the boiling

point, or, in other words, of giving out ($78{\cdot}15 \times (212-32) =$) 14067 units of heat.

Dulong's similar determination of the heating power of carbon is, 13268 units of heat per unit of weight of carbon.

The mean of these two determinations is 13668 units of heat. Now, taking the total heat of steam of atmospheric pressure to be 1146.6° F., one pound of carbon will evaporate $\left(\frac{13668}{1146{\cdot}6-212} = \right)$ 14·624 pounds of water from the temperature of 212° Fahr.

Let us now inquire what deduction from this absolute theoretic evaporation is inseparable from practice. In the first place, with the usual proportions of boilers, about twice as much atmospheric air passes through the furnaces as is required to furnish oxygen for the perfect combustion of the fuel; also, a large proportion of the air which is required to furnish even the exact quantity of oxygen for perfect combustion, is composed of nitrogen; hence, we have a large amount of useless atmospheric gases to be heated up, and a quantity of heat to be consequently lost, equal to the difference of their temperature on entering and leaving the boiler. The gaseous products of combustion also necessarily leave the boiler at an elevated temperature, in order to produce the draft; hence, another very considerable loss of heat. There is also a further practical loss by radiation. These losses, when the temperature of the smoke chimney is as low as about 350° Fahr., may be taken at about 30 per centum of the theoretic heat developed by the combustion, and with a higher temperature these losses will be proportionably greater.

First Experiment.—The first experiment deserving notice, is by Mr. Wicksteed, Engineer of the East London Water Works, Old Ford, England, with the Cornish boilers of that Company. The fuel was "small Newcastle coals of inferior quality." The data and results are as follows, viz:—

	Ordinary setting.	Baker's patent setting.
DATA.		
Duration of the experiment in hours,	207	108
Total pounds of coal consumed,	64940	31642
Pounds of coal consumed per hour,	313·7	293·0
Total pounds of clinkers and ashes made,	3895	2159
Pounds of clinkers and ashes made per hour,	18·8	20·0
Total pounds of coal consumed, after deducting clinkers and ashes,	61045	29483
Pounds of coal consumed per hour, after deducting clinkers and ashes,	294·9	273·0
Temperature of feed water in degrees Fahrenheit,	95½°	90°
Total pounds of water evaporated from temperature of feed water,	449320	243680
Pounds of water evaporated per hour from temperature of feed water,	2170	2256
RESULTS.		
Pounds of water evaporated from temperature of feed water, by one pound of coal, after deducting ashes and clinkers,	7·360	8.265
Pounds of water evaporated from temperature of 212° Fahr., by one pound of coal, after deducting ashes and clinkers,	8·277	9·344

From the above table it would appear that the result from the "Baker's Setting" was 12·9 per centum greater than from the "Ordinary Setting," taking the latter as unity; but as we are not informed whether the distance between the bottom of the boiler and the last bridge wall was the same in both cases, it is impossible to say whether this difference is owing to a better proportion of calorimeter or to Baker's curves.

The reader will be struck with the high absolute evaporation given in the above experiments, considering the type of boiler, and a little examination into it will be well bestowed. Now Richardson's ultimate analysis of Newcastle coal, after deducting clinkers, ashes, &c., gives the following composition, viz.

Oxygen,	8·57	per centum.
Hydrogen,	5·14	" "
Carbon,	86·29	" "
Total,	100·00	

Hence, the total absolute theoretical evaporation of this coal will be ($14{\cdot}624 \times 0{\cdot}8629 =$) 12·619 pounds of water from temperature of 212° Fahr. per pounds of coal. Now the coal consumed in the above experiments after deducting for clinkers and ashes, contained ($8{\cdot}57 + 5{\cdot}14 =$) 13·71 per centum of oxygen and hydrogen; hence the evaporation of 9·344 pounds of water per pound of coal with "Baker's Setting," will be increased to $\left(\frac{9{\cdot}344}{0{\cdot}8629} = \right)$ 10·829 pounds of water from temperature of 212° Fahr. by one pound of *carbon;* which allows a loss of only 14·2 per centum of the total theoretic evaporation, due to the draft, radiation, &c. The draft in these experiments was so sluggish, and the combustion consequently so slow, that when the doors of the furnaces were opened for firing, the smoke came out.

Second Experiment.

The second experiment deserving of attention, was made by Messrs. Borden, Parrott, and Nott, (composing a committee appointed by an Association of Civil Engineers of New England,) at the Linseed Oil Mill, East Boston, Massachusetts. The coal used was the red ash, Peach Mountain anthracite of Pennsylvania: the average weight of the lumps was 0·229 pound. The boiler was a plain cylinder. Each charge of coal was weighed whenever a new supply was needed, and the ashes, clinkers and unburnt coal were carefully weighed when removed. The water was evaporated under the pressure of 46 pounds per square inch above the atmosphere. With "Baker's Setting," five inverted arches were used, and the last bridge wall was 3½ inches below the bottom of the boiler: when this "setting" was changed to the "ordinary" one, it was effected by simply lowering the second bridge wall two bricks, and the third, fourth, fifth and sixth bridge walls three bricks, the latter being equal, including mortar joints, to a decrease in height of 8½ inches, making the total space between the bottom of the boiler and these latter bridge walls 12 inches.

From this description it is evident the results cannot be accepted as determining anything in favor of the "Baker's" over the "Ordinary Set-

ting;" for such a determination, it is indispensably necessary that the calorimeter, or distance between the boiler and bridge walls, should be the same; but here we see the calorimeter with the "Ordinary Setting" was nearly three and a half times greater than with the "Baker's Setting." The heated gases in both cases were passed over the furnace bridge wall through the same opening, but with the "Ordinary Setting" were allowed to immediately expand nearly three and a half times, thereby losing their temperature as a consequence of that expansion, and having a large proportion of their heat rendered latent. The results of these experiments then simply determine the relative economy of the two proportions of calorimeter, and no argument can be drawn from them in favor of the arches. The data and results of these experiments are as follows, viz.

	Baker's Patent Setting.	Ordinary Setting.
DATA.		
Duration of the experiment in hours,	48	48
Total pounds of coal consumed,	4362	4303
Pounds of coal consumed per hour,	90·87	89·64
Total pounds of clinkers made,	208	190
" " ashes "	341	332
" " partly burnt and unburnt coal fallen through grate bars,	232	354
Total pounds of coal consumed after deducting clinkers, ashes and unburnt coal,	3581	3427
Pounds of coal consumed per hour after deducting clinkers, ashes and unburnt coal,	74·60	71·39
Temperature in degrees Fahrenheit of the steam in boiler,	276°·90	278°·04
" " " " " feed water,	91°·15	89°·07
Total pounds of water evaporated from temperature of feed water,	31671	24157
Pounds of water evaporated per hour from temperature of feed water,	659·81	503·27
RESULTS.		
Pounds of water evaporated from temperature of feed water, by one pound of coal, after deducting clinkers, ashes and unburnt coal,	8·844	7·049
Pounds of water evaporated from temperature of 212° Fah. by one pound of coal, after deducting clinkers, ashes and unburnt coal,	9·945	7·976

From the above table it will appear, that the results from the *proportion of calorimeter* used with "Baker's Setting" was economically 24·7 per centum greater than with the *proportion of calorimeter* used with the "Ordinary Setting," taking the results by the "Ordinary Setting" as unity.

The composition of Pennsylvania anthracite, according to the ultimate analysis by Richardson, after deducting clinkers, ashes, &c., is as follows, viz.

Oxygen,	2·56	per centum.
Hydrogen,	2·55	" "
Carbon,	94·89	" "
Total,	100·00	

Hence the absolute total theoretic evaporation of this coal will be $(14{\cdot}624 \times 0{\cdot}9489 =)$ 13·877 pounds of water from temperature of 212°

Fahr. per pound of coal. Now the coal consumed in the above experiments contained after deducting clinkers, ashes, &c., ($2\cdot56+2\cdot55=$) $5\cdot11$ per centum of oxygen and hydrogen; hence the evaporation of $9\cdot945$ pounds of water per pound of coal with the proportion of calorimeter used with "Baker's Setting," will be increased to $\left(\frac{9\cdot945}{0\cdot9489}=\right)10\cdot481$ pounds of water from temperature of 212° Fahr., by one pound of *carbon*, which allows a loss of $24\cdot5$ per centum of the total theoretic evaporation, due to draft, radiation, &c.

(To be Continued.)

For the Journal of the Franklin Institute.

Details of Construction of Steamers.

The *St. Louis*, is the name of the steamer in which the details are given in page 353, Vol. XXVII. She is now employed upon the route between New York and Havre *via* Southampton, in place of the Franklin, lately stranded upon the Coast of Long Island. Her load draft will be 14 feet 4 inches. Her fore and aft water wheel guards have been removed.

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*On the Fatigue and Consequent Fracture of Metals.**

At a recent meeting of the Institution of Civil Engineers, a paper was read on the above subject by Mr. F. Braithwaite, M. Inst. C. E.

Many accidents, the causes of which had been pronounced "mysterious," having professionally engaged the author's attention, he had carefully examined the circumstances of each, and the condition of the fractured metal, in all cases, and at length arrived at the conclusion, that almost all the accidents might be ascribed to a progressive deteriorating action, which might be termed the "Fatigue" of metals.

Metal in a state of rest, although sustaining a heavy pressure or strain, as in a beam or girder, and exhibiting only the deflexion due to the superposed weight, would continue to bear that pressure without fracture so long as its rest was not disturbed, and the same strain was not too frequently repeated; but if either of these cases occurred a certain disturbance of the particles took place, the metal was deteriorated, and that portion subject to the reiterated strain was so far destroyed, that it ultimately broke down. This might also arise from sudden concussions, when the metal was under a certain strain, and those concussions might be caused by the girder being suddenly unloaded.

Several examples were given of accidents of the kind that had been alluded to; for instance, that of a vat in a London brewery, carried on cast-iron girders, by which it had been supported for some years; but suddenly, without any apparent cause, they broke, and killed and wounded some workmen. In this case it was shown that the girders were not originally sufficiently strong for the load, and therefore the intermittent load of the vat, which was sometimes full and at other times only partially so, and then empty, caused a constantly recurring deflexion,

* From the Mechanics' Magazine, May, 1854.

and a subsequent corresponding effort to regain its natural position, by which the composition of the metal was disturbed, and fracture ensued.

Other examples of the same nature were given, and it was shown that the repeated buckling of the tube-plate of a locomotive, arising from the action of the pistons, had a tendency to cause fracture mechanically; and also that the side-strains and vibrations to which suspension-rods of the ash-pans of locomotives were subjected, had produced very serious results, which it sufficed to point out forcibly to guard against the recurrence of.

The author contended, that presuming adequate dimensions to have been given to girders, and the stipulated weight not to have been exceeded, the chances of accident were remote, but that any repeated deflexion, either at intervals, or continued for so long as to induce a permanent depression, must be productive of danger, which could only be averted by altering or replacing the parts deficient in strength, and maintaining a rigid supervision, whether of beams when loaded, or of parts of machinery, or of railway stock after working. By such means accidents would be prevented, and a greater degree of confidence be established in structures in which metal was employed.

For the Journal of the Franklin Institute.

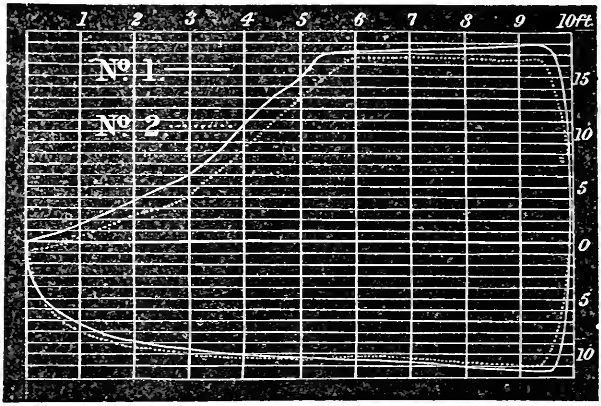
Abstract from the Steam Log of the "Baltic," Collins' Steamer, from Liverpool, July 8th, 1854. By Wm. H. Shock, Chief Eng. U. S. N.

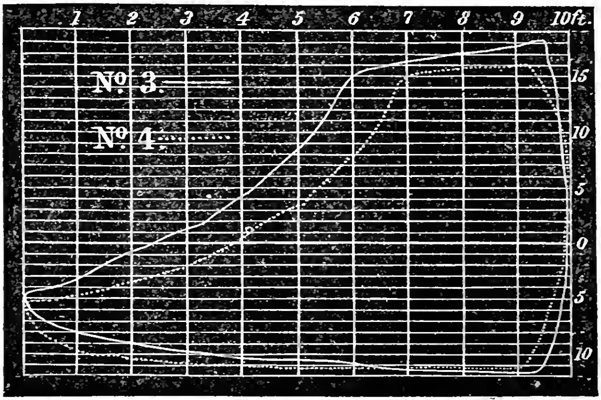
To the kindness of Chief Engineer, R. Robinson, of the "*Baltic*," I am indebted for, (and by which I am enabled to lay before the readers of the *Journal*,) an abstract of the steam log of that ship, during her late and remarkably quick run from Liverpool to New York. It will be seen, that she left Liverpool on Thursday, June 29th, and arrived in New York, July 8th, having accomplished the run in the unprecedented time of *nine days, sixteen hours, and fifty-three minutes.*

The "*Baltic*" has just been furnished with two new cylinders, of the same dimensions as those removed, viz. 95 inches diameter, 10 feet stroke, and this was the first voyage made with them, as well as with the new composition tubes recently fitted in her boilers. I do not find any *marked* improvement in the efficiency of the boilers, resulting from the adoption of the composition tubes; as I find as good an average of steam given her, with about the same consumption of coal, on previous voyages; the cause of this I attribute entirely to the loss sustained by reflection, in consequence of the smooth and bright surface of the tubes, which a few trips will suffice to remedy.

The diagrams are the *originals*, taken during the voyage, and consequently have not been submitted to the possibility of an error, by copying. Nos. 1 and 2, were taken at 10 A. M., June 29th, (on the first day out from Liverpool,) steam by gauge 17½ lbs., revolutions 13·8 per minute. Nos. 3 and 4, were taken at 10 A. M., July 7th, (on the day previous to her arrival in New York,) steam per gauge 17½ lbs., revolutions 16·7 per minute. Nos. 1 and 3, were taken from the *bottoms* of port and starboard cylinders, respectively. Nos. 2 and 4, from the *tops* of port and starboard cylinders, in the same order.

No. 3 diagram, it will be observed, shows a slight excess of pressure in the cylinder over that indicated by the gauge, an error which I presume occurred in noting the pressure from the gauge. The same diagram





shows also a defective steam line, resulting, no doubt, from obstructions in the pipe, leading from the bottom of the cylinder to a point convenient for attaching the instrument near the top.

Abstract of Log of Steamship Baltic.

Month.	Day.	Date	Ave. Steam.	Ave. Rev.	Total rev.	Time.	Coal	Knots run.	Latitude.	Longitude.
1854			lbs.			Ho'rs.				
June,	Thursday,	29	16	13·1	18,935	23	Average coal, 95 tons per 24 hours.	294	55° 30′	9° 48′
"	Friday,	30	17½	13·9	20,468	24		318	55 05	19 08
July,	Saturday,	1	17½	14·4	21,172	24		326	53 45	28 03
"	Sunday,	2	18	14·9	22,056	24		325	52 44	36 40
"	Monday,	3	18	15·4	22,739	24		327	50 56	44 06
"	Tuesday,	4	17½	15·4	22,696	24		324	48 00	51 04
"	Wednesday	5	17¾	16	23,381	24		322	45 20	58 00
"	Thursday,	6	17	16·3	24,007	24		319	42 50	63 45
"	Friday,	7	17½	16·6	24,412	24		332	40 45	70 40
"	Saturday,	8	16	16·4	13,220	13		160	miles to	dock.

Duration of passage, 9 days 16 hours and 53 minutes.

On the Results of a series of Experiments on the Decomposition of Water by the Galvanic Battery, with a view to obtain a constant and brilliant Lime Light. By the Rev. N. J. Callan, Prof. of Nat. Philos. in the Rom. Cath. Coll. Maynooth.*

Continued from p. 139.

Some of my experiments led me to believe, that, by means of the arrangement of the electrodes for a current of high intensity, the decomposing power of the battery may be considerably increased; from other experiments I was somewhat disposed to infer, that by such arrangement no increase of power can be gained. I am at present in doubt, and must remain so till the state of my health enables me to repeat my experiments.

The fluid which I first used in the voltameter was a solution of caustic potash. When a current was sent through the solution, the iron vessel was soon filled with foam, which came out through the jet with the mixed gas and extinguished the flame. I then tried a solution of carbonate of soda. The soda prevented the oxidation of the positive electrode as well as potash, and did not foam so much. However, even with soda, the quantity of foam was so great, that the iron voltameter, 16 inches high and 6 inches in diameter, would be very soon filled with it if a battery of more than about twelve 6-inch cells were employed. I tried various means of preventing the foam. I first covered the electrodes all round with a cloth, so that the gases should pass through it. Many of the bubbles were thus broken; but when a powerful battery was used, the voltameter was soon filled with foam. I then put about a teaspoonful of coal naphtha into the vessel. This prevented the foam from rising to any considerable height in the vessel, but it was somewhat injurious to the light. I also tried turpentine: it diminished the foam, but injured the light more than the naphtha. I think it increased the violence of the explosion of the gases. I afterwards tried some nitre, and also common salt; each of them prevented the foam, but destroyed the light. After failing in all my efforts to prevent the foam, I thought there was no alternative but to get an iron vessel so large that all the foam which could be produced by a powerful battery would be contained between the top of the electrodes or surface of the fluid, and the top of the vessel, without rushing through the jet. Latterly, I have tried carbonate of ammonia instead of soda, and have found that it foams much less, and that it prevents the action of the oxygen on the positive electrode. A solution of the proper strength will be obtained by dissolving an ounce and a quarter, or an ounce of the carbonate of potash, soda, or ammonia in a quart of water. If there be more than an ounce and a quarter to each quart of water, the quantity of foam will be very considerable; if there be less than an ounce, the conducting power of the solution will not be sufficient, and the quantity of the gases produced will be greatly diminished.

For either of the two arrangements of the electrodes I have described, a cylindrical vessel does not answer well. For them a prismatic vessel having a rectangular bottom is the most convenient. The inside of the

* From the Lond., Edin., and Dub. Philos. Mag., Feb., 1854.

iron vessel should be coated with an alloy of lead and tin, or of lead, tin and antimony, in which the proportion of tin, or of tin and antimony, is small,—first, in order to preserve it from rust; secondly, to protect it against the action of sulphuric acid, and thus render it fit for a voltameter, in which the positive electrode is platina; the negative one, tin plates coated with an alloy of lead and tin; and the fluid through which the voltaic current passes is dilute sulphuric acid. The coated sides of the vessel may be the negative electrode. With an iron voltameter such as I have described, the mixed gases may, without the slightest danger, be inflamed as they are produced by the decomposition of water, and a constant and brilliant lime light may be obtained.

The third result is a new negative element, cheaper, more durable, and one which may be made to act with greater power than the platinized silver used in Smee's battery. It is sheet tin, coated with an alloy of lead and tin, in which the proportion of tin is not greater than that of lead, or of lead, tin, and a small quantity of antimony. On tin plates thus coated, the dilute sulphuric acid commonly used in Smee's battery will scarcely exert any action. It may be platinized like sheet silver; or it may be coated with borax, and will then answer as well, or very nearly as well, as if it were platinized. It is evident that tin plates thus prepared are far cheaper and more durable than platinized silver; and because they can be brought nearer than platinized silver to the zinc plates without danger of touching them, they may be made to act with greater power.

The fourth result is a new means of protecting iron against the action of the weather and of various corroding substances, so that iron thus protected will answer for all the purposes to which sheet lead and galvanized iron are applied. Besides the experiments by which I have proved the superiority of tin plates (that is, of sheet-iron plates), coated with an alloy of lead and tin, over leaden ones, as the electrodes of a voltameter, I have made many others, in order to compare the action of concentrated nitric, sulphuric and muriatic acid, as well as of dilute sulphuric and muriatic acid on lead and galvanized iron, with their action on iron coated with an alloy of lead and tin, in which the quantity of lead was about equal to that of tin, or from two to seven or eight times as great as that of tin; and from these experiments I infer that iron, coated with any of the above-mentioned alloys, is less oxidable and less liable to corrosion than lead or galvanized iron, the zinc coating of which, as every one knows, is rapidly dissolved by the acids, even when they are greatly diluted with water. Iron, then, coated with an alloy of lead and tin, in which the quantity of lead is nearly equal to, or exceeds that of tin, will answer as well as lead or galvanized iron for roofing, cisterns, baths, pipes, gutters, window-frames, telegraphic wires, for marine and various other purposes. A small quantity of zinc, mixed with the alloy with which the iron is coated, hardens the coating, but diminishes its power of resisting corrosion. But the addition of a little antimony not only hardens the coating, but also makes it less oxidable and less liable to corrosive action. Iron, coated with the alloy of lead and tin, or of lead, tin and antimony, may answer better than lead for vitriol chambers. It may be sometimes used instead of copper for the sheathing of ships;

and bolts and nails of coated iron may be sometimes employed instead of copper bolts and nails. It may also be used for some of the purposes for which enamelled iron or cast iron is employed, such as the enamelled cast iron cisterns and pipes used in water closets. At the last meeting of the British Association at Hull, Dr. Gladstone stated, that the owners of iron built ships object to sugar cargoes, because the saccharine juices that exude from the casks corrode the metal. If the casks or the ships were lined with thin sheet iron, coated with an alloy of lead and tin, containing two or three times as much lead as tin, it is highly probable that the corrosion of the ships would be prevented. I have left for a considerable time a small piece of an alloy of lead and tin, in which the quantity of lead was four or five times as great as that of tin, in a solution of sugar and common water; and the alloy came out as bright as when it was put into the solution.

The fifth result is a new mode of producing, by means of a small galvanic battery, a brilliant intermittent lime light. By means of a battery of twelve 4-inch cast iron cells, or of four cells each 6 inches by 8, a small voltameter, such as I have described, and a good Hemming's jet, a constant lime light, about a quarter of an inch in diameter, may be produced. If then the jet be attached to a stop-cock, by which the gases are confined in the iron voltameter for fifty-five seconds in each minute, and are allowed to issue from the jet only for five seconds in each minute, twelve times as much of the gases must pass through the jet in these five seconds as would pass through it in the same time were the stop-cock always open. Hence if the gases produced by the battery are ignited for five seconds in each minute as they issue from the jet, and are confined in the voltameter for the remaining fifty-five seconds, the flame will, when thrown on lime, give a light twelve times as large as one a quarter of an inch in diameter, or nearly seven-eighths of an inch in diameter. If the breadth of the hole in the key of the stop-cock be $\frac{1}{24}$th of the circumference of the key, and if the key make a revolution in every two minutes, the stop-cock, because it is opened twice in each complete revolution of the key, will be opened once in every minute for five seconds, and will be closed for fifty-five seconds. Now, by clock-work, it is very easy to make the key of the stop-cock perform a revolution once in every two minutes, and consequently to produce a lime light seven-eighths of an inch in diameter for five seconds in every minute. It is easy to make the motion of the key and the ratio of the diameter of the hole to the circumference of the key such that the stop-cock will be opened once in two minutes for ten seconds, and will be closed for a minute and fifty seconds. In order to light the gases whenever the stop-cock is opened, it is necessary to have a small flame of gas or of a candle always at the nozzle of the jet. A lime light of seven-eighths of an inch in diameter would be seen at a far greater distance, particularly in foggy weather and in snow-storms, than the light of a lamp; and is therefore of the utmost importance in light-houses. Had there been such a light in the Bayley Light-house, the *Victoria* would in all probability not have been lost. The expense or trouble of such a light would not be very great, and would be amply compensated by saving the lives of many every year. The light might be used only in foggy weather or in snow-

storms, when a light capable of penetrating through a dense atmosphere or a shower of snow would be required. On other occasions the ordinary lights might be employed. The expense of an intermittent lime light, such as I have described, would be the cost of working a cast iron battery, containing four zinc plates, each 6 inches by 8, for sixteen or seventeen hours a day, and of a very minute flame of common coal-gas for the same space of time, as often as the light might be required. Surely such an expense could not be very great. Should it be apprehended that the action of the battery would not be sufficiently constant to give the light required, then three large gas bags, each of which would contain as much of the mixed gases as would be sufficient to maintain a lime light three-fourths or seven-eighths of an inch in diameter for half an hour, might be filled during the day with the mixed gases by two or three small batteries. Then, by means of the apparatus which I have devised for safely applying the mixed gases to the production of intense heat and light, of a proper jet, a suitable adjustment of clock-work, and a very small flame of coal-gas, the intermittent light may be kept up for eighteen hours; for the light would last only five seconds in each minute, and consequently only five minutes in each hour, or an hour and a half in eighteen hours. Therefore, since the three gas bags, filled with the mixed gases, would maintain a constant light for an hour and a half, they should keep up the intermittent light for eighteen hours. I believe such an intermittent would answer very well for light-houses. In the light-house on the eastern pier at Kingstown, the light is a revolving one, which completes a revolution in about a minute. The brilliant white light, the only one which can be seen at a distance, shines out only for about five seconds in each minute. Hence I infer, that an intermittent lime light which lasts for five seconds in each minute would be sufficient for light-house purposes. It is necessary to observe, that, when gases are gradually cut off from the jet, the gases in the upper part of the voltameter, or vessel to which the jet is attached, will explode if a Hemming's jet be not used; and this explosion, though perfectly free from danger, will be attended with inconvenience, for a vacuum will be produced in the upper part of the voltameter or vessel, and no gases can pass to the jet till this vacuum is filled. Hence, in producing an intermittent lime light, a Hemming's jet should be employed. Since the discovery of the cast iron battery, several persons have obtained patents for apparatuses for the coke light, or, as it is now called, the electric light. If they arranged their apparatus so as to produce an intermittent coke light similar to the intermittent lime light I have described, they would confer a great benefit on society. When the coke light is constant, the battery is soon exhausted, the coke points are consumed, and must be frequently renewed; but were the light intermittent, a single charge of the battery might last for an entire night, and it would be sufficient to renew the coke points two or three times in the course of the night. And if an intermittent coke light were used in light-houses only on very dark and foggy nights and in snow-storms, the expense could not be considerable. I think the coke light is more intense than the lime light, and also somewhat less expensive. To produce a coke light sufficient for all illuminating purposes, forty cast iron cells, each containing a zinc plate 2 inches by 4,

will suffice. To obtain a lime light of equal illuminating power, a battery containing at least twice as large a surface of zinc will be required. A battery with a given charge will scarcely work twice as long in decomposing water as in igniting a pair of coke points. Therefore, on the whole, I think the lime light is more expensive, but much more easily managed than the coke light. The former requires a battery of only four large plates; the latter depends on the intensity of the current, and requires a battery of at least thirty-five or forty cells. The coke points will require to be changed more frequently than the lime; and there is more reason to fear that the coke light will fail on account of the destruction of the positive coke point, than that the lime light will go out on account of the wearing of the lime. For the coke light, the zinc plates should not contain more than 8 square inches of surface. If they be larger, the positive coke point will be rapidly destroyed, without a proportional increase of light.

The sixth result is a new mode of exhibiting the dissolving views by means of the lime light. In the common apparatus for showing the dissolving views, the apertures of the lanterns are gradually opened and gradually closed, in order to make the figures come gradually into view and gradually disappear. By using the mixed gases, the apertures may be left always open, and the figure in either lantern may be gradually brought out on the screen, and may be made to fade away by degrees; for by opening very slowly the stop-cock through which the gases pass to the jet, the light in the lanterns may be made to increase very slowly till it has acquired its full intensity, and consequently the image thrown on the screen will become gradually brighter till it attains its full brightness; and by very slowly closing the stop-cock, the light, and consequently the image, will gradually fade away. By exhibiting the dissolving views in this way, there is a great saving of the mixed gases; for the light shines out fully in each lantern only when it is necessary to exhibit the image in full brightness on the screen. Besides, by diminishing the quantity of the gases which passes through one jet, the quantity which passes through the other jet, and consequently the brightness of the full image, is increased.

The last result is a new sine galvanometer, which is the only instrument yet devised for measuring with accuracy very powerful galvanic currents.* Some of my experiments raised doubts in my mind about some of the generally received theories relating to the action of the galvanic battery. The galvanometers which I had were not fit for measuring very powerful currents, such as I employed. I was therefore obliged to get a new one. After a good deal of reflection, I resolved to get one which would answer for a sine instrument, for the common tangent instrument, and for the new tangent galvanometer, the principle of which is demonstrated in the *Comptes Rendus* of the 24th of last January. The galvanometer which I have made consists of a mahogany circle, 2 feet 4 inches in diameter, and nearly 2 inches thick, in the circumference of which is turned a groove half an inch wide and $3\frac{1}{2}$ inches deep; of seven concentric coils of $\frac{3}{8}$ inch copper wire in the groove, and well insulated

* The voltameter will not measure powerful currents produced by a single circle, or by two or three circles.

from each other; of a strong frame in which the circle is movable on an axis, and always kept in a vertical position; and of a compass-box, which, by means of a slide 3 feet long and at right angles to the circle at its centre, may be moved in a direction perpendicular to the circle to the distance of 3 feet from it, so that the centre of the needle, which is a bar needle $5\frac{1}{8}$ inches long, will always be in the axis of the circle and of the coil, and that the line joining the north and south points of the compass-box will be always parallel to the horizontal diameter of the mahogany circle and coil. From this description of the instrument, it is evident that (no matter where the compass-box is placed on the slide) the needle is parallel to the mahogany circle and coil, or perpendicular to their axis, whenever it points to 0°. Hence, if a voltaic current, sent through the coil, deflect the needle, and if the circle and coil be turned round so as to follow the needle until it points to 0°, the needle, no matter where it may be placed on the slide, will then be parallel to the coil and perpendicular to its axis. The magnetic power of the coil is exerted in the direction of its axis. The effective part of the earth's magnetism in impelling the needle to the magnetic meridian is also exerted in the direction of a perpendicular to the needle or of the axis of the coil, but opposite to that in which the magnetic force of the coil acts. Since the needle is kept at rest by these two forces acting in opposite directions, they must be equal. But the effective part of the earth's magnetism in impelling the needle to the magnetic meridian, varies as the sine of the angle which it makes with that meridian. Therefore the magnetic power of the current flowing through the coil also varies as the sine of the angle which the needle, when it points to 0°, or the mahogany circle D, makes with the magnetic meridian. If the connexion with the battery be broken, the needle will immediately return to the magnetic meridian. The graduated circle of the compass-box will give the number of degrees the needle was deflected from the magnetic meridian. For measuring the angle of deviation, I have used a large graduated circle about 13 inches in diameter, which is attached to the upper part of the mahogany circle, and at right angles to it and to the axis about which it is movable. By means of seven brass bolts, each three-eighths of an inch in diameter, I can send the current from the battery through one coil, or seven, or through any intermediate number of coils. I scarcely ever use more than one coil, and that is the outside one, the diameter of which is about 2 feet 2 inches. When the current is sent through seven coils, the deflexion is so great that only very feeble currents can be measured on the sine galvanometer. When the needle is in the centre of the coil, this galvanometer, used as a sine instrument, large as its diameter, is not capable of measuring the power of a current produced by a single circle of the cast iron battery, in which the zinc plate is an inch broad and 4 inches long. The coil, when made to follow the needle, drives it always before it, so that the needle will never remain parallel to the coil. Hence, in Pouillet's sine galvanometer, in which the centre of the needle is in the centre of the coil, only feeble galvanic currents can be measured. But by sliding the compass-box and needle to 2 or 3 feet from the coil, a current of very great power may be measured. A current which produces a deflexion of 75° when the needle is in the centre of the coil, will

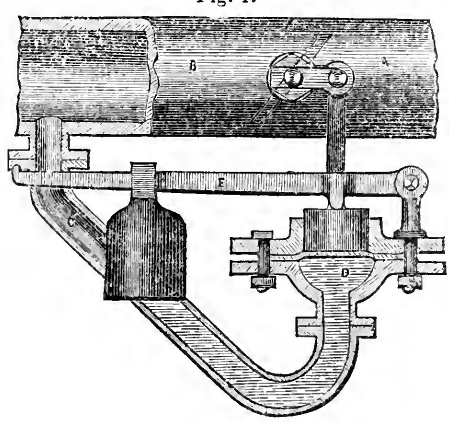
produce a deflexion of only 3° when the needle is at a distance of 3 feet from the coil and its centre in the axis of the coil. Hence, by our galvanometer, in which, and in which alone, the needle may be moved to a distance from the mahogany circle or coil whilst its centre is in the axis of the coil, currents of enormous power may be measured. With this galvanometer I expect to determine,—first, the smallest number of circles, the currents of which will be fully effective, or at least as effective as any larger number of galvanic circles in decomposing water, and consequently the number which may be used with the greatest advantage in decomposition; secondly, whether Mr. Faraday's law, viz. that the quantity of the mixed gases produced by a voltaic current is proportional to the quantity of electricity which passes, holds for currents of great power; thirdly, the proportion which the surface of the decomposing plates should bear to the acting surface of zinc in each circle; fourthly, whether a battery with a given charge will work longer in producing the lime light by decomposing water than in producing the coke light, and which of the two lights is the more economical.

(To be Continued.)

Description of Apparatus for Regulating Steam Pressure. By M. Gray.*

The great advantage to manufacturers and the employers of steam machinery—derivable from a simple means of obtaining invariable or uniform low pressure steam from a single source of variable or irregular pressure—have led me to adopt the apparatus represented in the two sketches annexed. Both arrangements are obvious modifications of the well known regulators patented and made by Mr. David Auld, who is now introducing the new forms for various manufacturing purposes, as being free from the defects of the steam piston plans, which are liable to stick, or to pass steam. In fig. 1, A B is the main steam pipe, conveying the initial high pressure steam from the boiler to the scene of operation of the lower pressure, the current being in the direction from A to B. From the side, B, a small branch pipe, C, passes downwards, and opens up, by a quick bend, into the lower side of an elastic diaphragm chamber, D. And to prevent the steam itself from coming in contact with the diaphragm, water is allowed to collect in this pipe, to form the actual means of communication with the chamber. This chamber is a simple cup, having a disk of vulcanized india rubber stretched across it, and held down by the

Fig. 1.



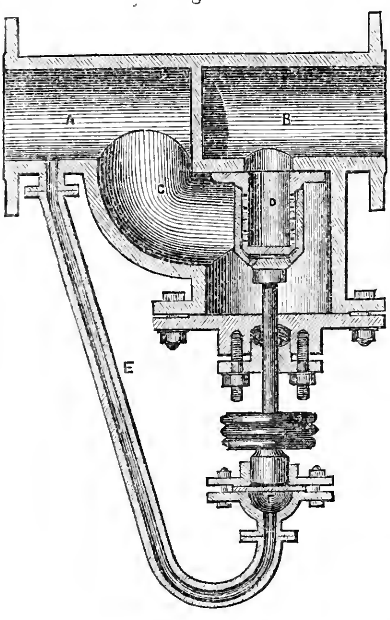
* From the London Practical Mechanics' Journal, April, 1854.

flanch of an upper bored cap, answering as a guide for a short plunger. The bottom of the plunger rests upon the elastic diaphragm, and a link passes up from it to the crank arm of a common throttle valve, forming the separation between the two parts, A B, of the main steam pipe above. The plunger is also additionally loaded by a lever, E, with an adjustable weight upon it.

To those who have given any attention to similar matters, the action of the arrangement must be pretty obvious. The steam from the side, B, of the main pipe, presses upon the under side of the elastic diaphragm, and thus closes more or less the throttle valve in the main pipe. This reduces the steam flow from the side, A; and by shifting the weight back or forward on the lever, E, the attendant can at once obtain any pressure less than that in the boiler, as he may require it. The further the weight is set towards the end of the lever, the less will the throttle valve be closed, and consequently the higher will be the pressure of the steam flowing off at B.

Fig. 2 is a similar sectional view of another modification, wherein an equilibrium valve is used instead of a common throttle valve. The two sections or chambers, A B, form part of the line of main pipe. From the section, A, a wide pipe, C, opens into the chest of the balance valve, D, which is worked from below, and opens into the section, B. A second and narrow pipe, E, also opens from the side, A, in an elastic diaphragm chamber, F, fitted with a plunger, as in the former arrangement. The spindle of this plunger carries a series of adjustable weights, and it extends upwards and enters the balance valve chamber by a bottom stuffing box, the entered end of the spindle being attached to the sliding cup of the valve. The high pressure steam enters the section, B, of the main pipe, and passes through the balance valve to the branch, C, and thence to the section, A, from which it finds its way to its place of use. The branch pipe, E, from the reduced pressure side, as in the former example, affords the necessary means of regulation, adjustable by means of the movable weights on the plunger spindle.

Fig. 2.



This system of regulation has been some time in successful operation at the cotton mill of Messrs. James Black & Co., Peel Street, Mile-End, Glasgow.

Glasgow, March, 1854.

For the Journal of the Franklin Institute.

Particulars of the Steamer Indiana.

Hull built by C. J. Mare & Co., London. Machinery by Maudslay, Son & Field, London. Intended service, East Indies.

HULL.—

Length on deck, from fore part of figure head, to after part of stern post above the spar deck,		270 feet	3 inches.
Length on deck, from taffrail to stern,		253 "	7 "
" "		240 "	3 "
Breadth of beam at midship section,		38 "	4 "
Depth of hold,		27 "	10 "
" " to main deck,		20 "	4 "
Draft of water at load line,		17 "	4 "
" " below pressure and revolutions,		15 "	6 "
Tonnage,	2500.		
Masts and rig—	Barque.		

ENGINES—Inclined athwartwise—

Diameter of cylinder,			55 inches.
Length of stroke,		2 feet	6 "
Maximum pressure of steam in pounds,	12.		
Maximum revolutions per minute,	50.		

BOILERS—Four—tubular.

Description of coal,	Bituminous.
Draft,	Natural.
Consumption of coal per hour,	2800 pounds.

PROPELLER—of Maudslay's patent—connected direct to engine—

Diameter of screw,		15 feet.
Pitch of "		21 "
Number of blades,	2.	

Remarks.—Frame of wrought-iron ┐ Z, 4 and $5\frac{1}{2}\times\frac{3}{8}$ inch. Floor timbers *molded* $5\frac{1}{2}$ inches. *Sided* $\frac{3}{8}$ inch. Distance of frames apart *at centres*, 14 and 22 inches. Thickness of plates, $\frac{7}{8}$ $\frac{3}{4}$ and $\frac{5}{8}$ths. One air pump in common. Clincher built and single riveted. Frames are alternately single and double, as above shaped, and are connected athwartwise by an iron plate 16 inches deep at the keelson centre line.

Translated for the Journal of the Franklin Institute.

Changes of Length in Bars under the Influence of their own Weight.

M. J. T. Silbermann has endeavored to measure the elongation by its own weight of a bar suspended freely, and the shortening which it undergoes from the same cause, when resting vertically upon its base. Although these changes are very small, yet they may not be altogether negligable in very accurate determinations.

For the purpose of measuring these variations, M. S. made use of a system of two coupled rules, the one of platina, the other of bronze, form-

ing together a Borda thermometer. The following is briefly the description:

The platina rule covers that of bronze, and is attached to it, near one of its extremities, by a screw with conical centre, which traverses both. At 965 millimetres (38·00556 inches,) from the centre of this screw is the zero line of the vernier screwed on to the side of the bronze rule; this vernier corresponds to a division traced on the flat surface of the platina rule, and gives the variations of length in hundredths of a millimetre, and also, permits by means of a lens, to estimate the thousandths. A vernier and division are placed opposite to the centre of the screw for the assurance of its invariability. The two small rules of platina on which these two verniers are cut, serve as a guide to one side of the rules to prevent their lateral deviations; in the same way, there was fixed on the bronze rule and opposite the verniers, a small bronze rule, which like them, touched the upper surface of the platina rule and assisted in guiding the two rules, without, however, compressing them or preventing them from elongating or contracting independently of each other.

These two rules, of nearly the same length and weight, were submitted to two different modes of experimenting. In the first mode, the two rules were suspended vertically and freely by their upper part, the conical centre which united them, being above, and near the point of suspension. The mean of the vernier readings was —0·01833 mm. In the second mode, the two rules were turned upside down, and rested vertically upon the same end, now the lower; the mean of the vernier was +0·01833 mm. These means represent only the difference of the effect on the two rules. To get the absolute effect for each, it was necessary to use a new vertical position, partaking of the other two. In this, the conical centre was above, as in the first position, but in place of suspending the system, the bronze rule was alone supported on its base, while that of platina remained suspended from it by the screw, and, consequently, remained invariable in these two positions, while the bronze, which was now compressed, both by its own weight and by that of the platina, was formerly stretched by its own weight alone: the mean of the readings gave —0·00833 mm.

Taking into account the weights and opposite actions in the first and fourth experiments on the bronze rule, we get the absolute movement of this rule, 0·00329 mm.; adding this value to the observed difference $\pm$ 0·01833 mm. we get $\pm$ 0·2275 for the absolute change of the platina rule. As these values refer to the length, 965 mm. we shall get, by reduction to the standard, for the elongation or shortening of rules one metre long by their own weight. For bronze $\pm$ 0·00341 millimetres,

Platina $\pm$ 0·02305 "

Thus according as graduated scales are suspended, as in barometers, where they are moreover elongated by the weight of the glass and mercury, or in cathetometers, where they are either elongated or shortened according to the construction, we have corrections to introduce into the results. This is, above all, necessary, in the delicate measurements of the simple pendulum.

It will be observed, that the zero or vertical point, that is, the length

when not under the influence of the weight, is the exact mean between the positions of lengthening and shortening in the first and second experiments. M. S. was curious to know, whether if the rules left one or the other of these contrary positions, the vernier would come to 0, when they were laid horizontally. This was tried in the following way: the rules suspended at first, vertically, along a carefully adjusted plank were afterwards supported on a foot at the bottom; after each of these modifications, the plank was inclined gently until it with the rules took the horizontal position. The following results were obtained, after elongation the horizontal reading gave the mean —0·00376 mm. after shortening +0·00766 mm. Thus the two rules remained lengthened after the experiment of elongation, and shortened, after the experiment of compression, and in the latter case, the difference was considerable.—*L'Institut*, Vol. xxii, p. 168. *Acad. des Sciences de Paris*, 15th May, 1854.

Translated for the Journal of the Franklin Institute.

Process for Heliographic Engraving.

M. Baldus takes simply a plate of copper, and spreads upon it a sensitive coating of *bitumen of Judea.* Upon this plate, thus covered, he lays a photograph on paper of the object to be engraved. This photograph is positive, and must consequently, impress a negative on the metal by the action of the light. After about a quarter of an hour's exposure to the sun, the image is produced upon the resinous coating, but is not visible, and it is made to appear by washing the plate with a solvent, which removes the parts not affected by the light, and allows the picture to be seen represented by the resinous lines of the bitumen. The design, however, is formed by a veil so delicate and thin, that it would soon partly disappear if the plate remains in the liquid. To give it the proper firmness and resistance, it is exposed for two days to the action of diffused light; the picture being thus strengthened by its exposure to day light, the plate is plunged into a galvano-plastic bath of sulphate of copper. If, then, you attach the plate to the negative pole of the battery, you deposit on the unprotected parts of the metal, a coating of copper in relief; but if you attach it to the positive pole, you eat away the metal at these points, and thus form an engraving, so that you can, at will, according to the battery pole which you use, obtain either an engraving analogous to an ordinary copper-plate, which can be printed by the same process, or an engraving in relief, to be printed like a wood cut, with printing ink.

When it is desired to reproduce an ordinary engraving, clearly executed upon paper, as in the case assumed above, the photograph requires no peculiar preparation previous to its transfer to the metal. But this is not generally the object of photographic engraving; it is to reproduce natural objects without any intermediate process. When, then, it is required to reproduce, for instance, objects of natural history, landscapes, or monuments, the photograph used must be got in a way somewhat differing from the common mode. It is, in fact, the production of that which

engravers call the grain, that is, the lights, put by the graver in the shadows of the picture, which constitutes the essential difficulty in engraving photographs. The photograph has nothing of the kind, for the shadows are made of an uniform tint; we require, therefore, a peculiar artifice to produce this grain which does not exist in the photograph. In the works of MM. Rousseau, Déveria, and Riffaut, they are produced afterwards on the plate by the graver. In the new process, proposed by M. Baldus, this grain, so necessary for the engraving, is formed on the photograph itself, and the use of the graver thus rendered superfluous. This grain is formed on the negative photograph, by adding to the sensitive subtances, a compound which crystallizing in the paper, forms small transparent grains. The complete publication of all the details of this new process, which the author will doubtless make, will allow the curious chemical effect which takes place under these circumstances, to be understood.

There remains but a single word to be added; the proofs on paper obtained from these new plates of photographic origin, are so perfect that the great problem of engraving by the agency of light may be regarded as definitely solved. Not only this new process is going to reduce very much the price of engravings, but there is no artist or amateur of photography, who may not soon have the pleasure of reproducing, in a corner of his room, all the photographs which he obtains.

Cosmos, 26th May, 1854, p. 615.

Translated for the Journal of the Franklin Institute.

New Process for Procuring Phosphorus. By M. Cari-Montrand.

M. Dumas read to the Academy of Sciences, at Paris, at their Session of 15th May, a letter from a young chemist, M. Cari-Montrand, in which he proposes a new mode for the preparation of phosphorus on a practical scale, the usual process being slow, complicated, yielding but little product, and giving an educt of no value. The process proposed, consists of passing over a thorough mixture of equal parts of finely powdered charcoal and bone-earth, at a red heat, a quantity of dry hydro-chloric acid, or still better, of dry chlorine. The end of the porcelain tube in which the experiment was performed, was attached to a glass tube dipping under water. Phosphorus, carbonic oxide, and water, are given off, and chloride of calcium is left in the tube. On analysis, no trace of phosphoric acid, or any other compound, was found in the tube; the decomposition is therefore complete, and as no phosphorus passed off, the whole amount contained in the earth was obtained as a product. The following equation explains the reaction, when hydro-chloric acid is used:

$$3\,\mathrm{Ca.O,\ PO_5} + 5\,\mathrm{C} + 3\,\mathrm{H\ Cl.} = 5\,\mathrm{CO} + 3\,\mathrm{HO} + 3\,\mathrm{Ca.\ Cl.} + \mathrm{P.}$$

The same letter contains a notice interesting to chemists, of the entire decomposition of gypsum, and the procuring of its sulphuric acid, by

treatment of a mixture with charcoal by dry chlorine, or hydro-chloric acid gas. A good deal of excitement appears to have been caused among some of the would-be scientific papers, by the announcement of this process, which, it was asserted, would materially reduce the price of sulphuric acid. But it will be easily seen that, as at least the equivalent of hydro-chloric acid (dry weight 36) must be used for each equivalent of oil of vitriol, (weight 49,) the process would be more expensive than at present. This is clearly stated by M. Cari-Montrand, who had the process tried on a large scale by M. Kühlmann, but found that the expense of making and drying the hydro-chloric acid, was an insurmountable obstacle to its introduction into the arts.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, August 17, 1854.

J. Vaughan Merrick, President, pro tem., in the chair.

Isaac B. Garrigues, Recording Secretary.

The minutes of the last meeting were read and approved.

A letter was read from the Royal Society of London.

Donations to the Library were received from the Geological Society, and the Statistical Society of London. Hon. James Meachum, U. S. Congress; Prof. A. D. Bache, U. S. Coast Survey. The Kentucky Mechanics Institute, at Louisville Ky., Dr. J. Aitken Meigs, and Messrs. Lindsay and Blakiston, Philadelphia.

The periodicals received in exchange for the Journal of the Institute were laid on the table.

The Treasurer's statement of the receipts and payments for August, was read and approved.

The Board of Managers and Standing Committees reported their minutes.

New candidates for membership in the Institute (3) were proposed, and the candidates (4) proposed at the last meeting, were duly elected.

Dr. Rand, Chairman of the Committee on Meetings, exhibited a model of Mr. Truman's sewer trap. The throat of the sewer is closed by a bed plate pierced with an oblong opening, beneath which hangs a plate so counterpoised, as always to press against and close the opening. This plate or valve opens in proportion to the amount of liquid poured into the mouth of the sewer. There is also a pipe communicating above the surface, which is closed by the plate which shuts off the main opening, and is opened when it is depressed. This is intended to allow of the exit of compressed air, &c.

Also, a model of an apparatus for keeping boilers free from scale, invented by Mr. J. McMullen, of Baltimore, Md. A rod with a crank attached, passes through the head of the boiler having radial arms attached to it, and connected by rods passing longitudinally. These are covered with wire,

coiled spirally and free to move nearly against the surfaces of the boiler. By an oscillating motion of the crank, and consequently of the spirals, the inventor proposes to keep the water in a state of agitation, favorable to the liberation of steam, and unfavorable to the deposit of scale. A modified arrangement of the spirals is made to pass between the tubes in the locomotive boiler.

This invention is at present under consideration by the Committee on Science and the Arts.

Dr. Rand also presented a stove for warming, invented by Mr. A. Mayer. The gas is mixed with air and burned above wire gauze, covered with fine pumice. The flame impinges on an iron plate over which the air to be warmed passes. The products of combustion are taken out below. The whole is exceedingly neat in appearance, and the inventor claims economy as well freedom from noxious or unpleasant products.

Washington Jones exhibited a lithograph of C. H. Fondès' Rotary Dredger. The machine consists of a hull of suitable size to carry the machinery. In the middle of the boat athwartships, and near the bow running fore and aft, there is a well hole about three feet wide and twenty-six feet long. In this hole works a wheel carrying upon its periphery the buckets or scoops, made in the usual manner with a hinged bottom secured with a latch. The wheel has two hubs and two setts of arms stiffened with diagonal braces to prevent lateral motion; upon each side of the wheel is a segment spur wheel into which is geared the pinions driven by the engines.

The journals of the scoop-wheel shaft work in boxes that can be raised or lowered, by a chain and windlass, to suit the depth of the bottom to be operated upon. In a frame at the bow of the boat there are two hinged schutes, one of which, when the machine is in operation, is kept at one inclination; the other, situated above and leading into the first, to which it is hinged, is raised by each bucket as it passes upward; as the wheel revolves, the bucket passes beyond the reach of the schute where the end next the wheel falls beneath the bucket, striking a trigger that opens its bottom, leaving the contents free to fall into the schutes, and be conveyed by them into the transporting scows alongside.

The machine, for some kinds of work, must supersede all others where a long stretch can be had, such as a bar of a river, the bottom of a canal, &c., the performance must be admirable. No time is lost, except that spent in replacing the loaded scows with empty ones, and that, by practice, may be reduced to almost nothing. As the material is cut away, the boat is drawn forward by a rope anchored ahead, and passing round a barrel on the wheel shaft; the rate of progress for each kind of cutting, being regulated by the proper sized windlass barrel wheel can be quickly taken off and replaced by another.

It is said that a machine of the third class, having a wheel twenty-four feet in diameter with four buckets, has dug twelve hundred cubic yards of gravel bottom in a day.

JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS.

OCTOBER, 1854.

CIVIL ENGINEERING.

For the Journal of the Franklin Institute.

Rough Notes of an Exploration for an Inter-oceanic Canal Route by way of the Rivers Atrato and San Juan, in New Granada, South America. By John C. Trautwine, Civ. Eng., Philad.

Continued from page 155.

The San Pablo from the Certigui to the Confluence of the Raspadura and Santa Mónica, a distance of twenty-one miles.

Approaching the confluence of the Raspadúra and Santa Mónica, the San Pablo has an average width of about 100 feet, but in many places is restricted to 60 feet. The width of the boating channel, however, here becomes reduced to between 10 and 20 feet, with *ordinary* depths of some 3 to 4 feet. Near the Raspadúra, the average depression of the bed of the stream below the average summit of the regular levees, is about 9 to 12 feet. Consequently, the extremes of depth range from this latter limit, as a maximum, down to some 18 inches in the lowest stages, as a minimum. The bed, however, is much worn into pools with deeper water. An old negro, living on the banks of the San Pablo, but a mile above the entrance of the Cértigui, told me that even that far down, he could, at times, in almost every month, wade across with the water not above his middle, in mid-channel.

At a point 4 miles below the Raspadúra, where the fall of the stream appeared regular, I found it to be at the rate of 4 feet to a mile; but at another place, some two miles above the confluence of the Santa Mónica, at which also it appeared to be a fair average, a careful leveling of 300 yards in length gave a descent of 10 feet per mile.

On arriving at the confluence, I wished to ascend the Raspadúra, in preference to the Santa Mónica, inasmuch as the former is the branch by means of which the Cura of Nóvita is said to have connected the waters of the Atlantic with those of the Pacific, in the year 1788, as stated by Humboldt, *on the authority of other persons.* Our peones, however, who were well acquainted with both streams, dissuaded me from the attempt, by assuring me that in the present condition of the water, we could not possibly force our boat up it, although she drew but eight inches. We afterwards found that we had to drag her along portions of even the Santa Mónica.

So far as we could see up a short reach of the Raspadúra, from the place of confluence, it certainly appeared inferior to the Santa Mónica; being more encumbered by fallen trees, and exhibiting a more rapid descent and current. Having been assured, not only at Carthagena, but by old and intelligent persons in Quibdó, that the story of the Curás *Canal* was an exaggeration, I felt the less scruple in yielding to the confirmatory representations of our peones, to whom I had not previously spoken on the subject; having purposely omitted to do so, in order to obtain their unbiassed opinion; and they were too much fatigued when we reached here, to select the more laborious route.

The water of the Raspadúra was very muddy from the gold washing operations that were going on farther up the stream.

We had passed small parties engaged in this occupation, at short intervals, all the way from Quibdó. Gold occurs more abundantly on the Raspadúra, than on the Santa Mónica, in accordance with the general law of increase, in proportion as the streams head nearer to the Cordilleras.

The Andágueda has the reputation, throughout this region, of furnishing greater quantities, and particles of larger size, than any other of the tributaries. It will be seen from the Map, that this stream descends by several ramifications, from the spurs of the very Cordilleras.

The gravel of its bed, especially in the more elevated sections, is represented as being surpassingly rich. Its collection, however, is attended with great labor, in consequence of the precipitous character of the stream. This has washed its bottom into a succession of deep pools, in which the most valuable depositions of the metal occur, but from which they are proportionately hard of extraction.

Dr. Key informed me that some years ago, a diving bell was brought over from England, by some adventurers, to be used in the deep pools of the Andágueda; but for some reason or other, it was never applied to its intended purpose.

At the distance of a few miles above the Cértigui, the River Taridó enters the San Pablo from the west. At its head is an atravesia communicating with the Charidó, a small branch of the Baudó. Similar pathways across the ridge occur at the heads of nearly all the principal tributaries of the Atrato which enter it from the west: inasmuch, as they all have their sources opposite to, and within a few miles of, streams leading to the Pacific. See Map.

From the confluence of the San Pablo and the Raspadúra, to the head of canoe or ranchada navigation, a distance of eight miles, or 281 miles

in all from the mouth of Caño Coquito, or 61 miles above Quibdó, the stream loses the former name, and is called the Santa Mónica.*

This is a mere brook, very serpentine, and fluctuating in its depth almost every few hours. Its bed is much worn into pools, so that in low stages a great portion of its length presents a channel, continually varying from a few inches to two, three, or four feet of water. Near the confluence, its width between the banks generally ranges from 80 to 100 feet, and the depth of its bed below the tops of levees, from 6 to 10 feet; but as we ascend to the head of canoe navigation, these dimensions all become reduced about one-third part. The boating channel, however, usually occupies but a small proportion of the width, frequently, indeed, but two or three yards. By leveling portions of its bed, and removing a great many trees, the Santa Mónica would become well adapted for flat boats; but I should consider any further improvement a waste of money.

The numerous depressions, or rather *interruptions*, of the levees of the Santa Mónica and San Pablo, caused by the entrances of tributaries, or of wide marshy tracts on the same level, appear to me to render hopeless all ideas of improvement in the depth of those streams by any process of embankments, either with or without accessory locks and dams. Frequently, portions of even the natural levees are precipitated into the river by the combined action of undermining, and of hydrostatic pressure of the back-water attendant on the rapid subsidence of the streams after an overflowing freshet.

When we descended the Santa Mónica, in a flood stage, a boat drawing three, or perhaps even four feet, could have navigated it in safety, notwithstanding the great number of trees which cover its bed. But in ascending it now, the trees, for a few miles in the upper part, gave us a great deal of trouble; and the water being in many places but 5 or 6 inches deep, we had to get out and drag our boat for considerable distances at a time. The peones had occasionally even to scoop away the gravel with their hands in advance, to enable us to force her along.

After a few hours of this species of navigation, they became completely exhausted, and could proceed no farther; so that at 2 o'clock, P. M., we were compelled to stop for the day, at a negro hut, less than half a mile below our intended place of disembarkation. Had I known we were so near it, we should have shouldered our baggage, and navigated on foot; but the peones felt a delicacy in informing me of the fact, lest I should insist upon taking the boat along.

We had the comforting assurance, however, of experience, that we should not have to wait long for rain enough to allow us to proceed; and, accordingly, as evening closed in, it came down in true tropical style. Although it slacked off considerably before morning, it still left us some three feet of water, so that by sunrise we were at the "tambo."

This word, strictly interpreted, means a tavern; but throughout Span-

*The most erroneous map of the Atrato that I have seen, is one recently published by a Member of the Royal Geographical Society of London. In it, the Atrato is said to be laid down from recent observations by the Chief Engineer of the New Granadian Government. My own protractions confirm the superior accuracy of Col. Acosta's representation of that river, to a remarkable degree; proving that neither he nor I can be *much* in error, although I was far from aiming at *scrupulous* accuracy in my survey of it.

ish America, so called, it applies to any building erected at an embarcadéro, or place of embarkation. All such erections necessarily partake, more or less, of the character of places of public entertainment, even though they afford entertainment of no kind whatever ; or, (as in the case of that at the western end of the atravesia from the Pató to the Baudó,) cannot as much as boast of a regular tenant.

This, however, which is called the Tambo de San Pablo, or of St. Paul, has a tenant, and serves as a receptacle for the accumulation of goods and produce while waiting either for bipedal beasts of burden to transport them on their backs across the atravesia or crossing place, to San Pablo; or for boats, or water sufficient to carry them down the stream.

Here we were told that the Santa Mónica became as reduced as it was yesterday, (that is, to a few inches,) in nearly every month of the year ; and that in the Veranillo de San Juan, it in many places presented a channel but 3 or 4 feet wide, and 3 or 4 inches deep.

Even up to this point, the immediate banks were levees, a little higher than the ground back of them.

As we reached here on Sunday morning, we at first determined to make it a day of rest, prior to commencing our measurements and levels across the atravesia to the San Juan, on the next morning. But finding, after an hour's sojourn, that the character of the individuals just then congregated there, was not such as to invite overtures towards a cordial fraternization, we concluded to walk over to San Pablo, which is, by our measurement, but three and three-quarter miles distant by the path; or three and a quarter in a straight line. Short as this distance is, yet when the pathway happened to be very muddy, immediately after a heavy rain, it sufficed for an extremely fatiguing walk. We were, in several places, compelled, while in a state of profuse perspiration, to enter water three feet deep ; and for a great portion of the distance to trudge through stiff mud, reaching to near the tops of our boots, and clogging them with some pounds of extra weight. Once we were full two hours and a half in crossing. It is true, poles and small squared timbers are laid along parallel to the path for much of the way, ostensibly for the convenience of travelers ; but they are usually so narrow and slippery, that I rarely availed myself of them. Yet this is the most traveled road or pathway in this region.

Preparatory to setting off, I ascended the stream for a few hundred yards from the tambo, to bathe. While enjoying this luxury, I was somewhat startled for an instant, by the sudden apparition of a venerable, grave-looking, white-haired, negro woman, who came wading slowly down the creek, holding a small totuma, or calabash bowl, carefully in her hands. In the surprise of the moment, I might have mistaken her for a respectable old baboon, taking a morning stroll, with a cocoa nut in its paws, had it not instantly occurred to me that that animal, with all its sagacity, had not yet adopted the practice of wearing diapers, or smoking segars.

After an exchange of salutations, I approached her in as delicate a manner as the peculiar circumstances of the case permitted ; and, with more curiosity than politeness, begged permission to inspect the contents

of the totuma. She consented; and I found it to be a small quantity of gold dust which she had just collected from the bed of the stream.

Nearly the whole surface of the country is covered by a thick layer of the gold and platina bearing diluvium. Even the hill of Barro Blanco, (or white mud,) which is the highest ground between the Tambo and San Pablo, rising 144 feet above the former, and 247 feet above the latter, (See the "Route of the line of Levels" on the Map,) appears to consist exclusively of it; and there is not a single stream from the bed of which these metals may not be extracted. I conscientiously believe, from all I could learn of the richness of this strip of country, that were it in the United States, the gold that might be collected from the necessary excavations, would defray the entire cost of a first class railroad. This may appear to many to be the language of exaggeration; but I can assure the reader that it conveys my sincere convictions.

I will even tax his credulity still further, by asserting that gold dust is *actually daily collected*, (almost indiscriminately as regards details of locality,) over an area of *at least* some two thousand square miles of the Western slopes of the Western Cordilleras; while the exportation of it from the Eastern slopes of the same range, annually amounts to some millions of dollars, even now.

In many places, the banks of the streams exhibited layers of semi-bituminized leaves and branches in contact with the gold gravel; in some cases above, and in others, either below it, or alternating with it.

It is not the Atrato and San Juan alone, that penetrate to the El Dorado of New Granada. The Great Magdalena, and its equally great tributary the Cáuca, "roll down their golden sands" from the same inexhaustible repository of nature's treasures.

In the valleys of these streams some few rude attempts have been made at mining the gold and silver *veins* in a somewhat systematic manner; and the exports of gold from them annually, amounts to some three or four millions of dollars. It goes chiefly to France and England.

The hill of Barro Blanco is a singular isolated elevation, half a mile long, and but from three to five yards wide on top, and with steep sides, covered thickly with trees and undergrowth. In conformity with the "costumbre del pais," the pathway is carried over the entire length of the summit of this hill, instead of following the depressions that present themselves at the distance of but a few rods on either side of it, and apparently 60 feet lower, as nearly as we could judge by eye.

This circumstance, by the bye, reminds me that in speaking of the atravesia from the head of the Pató to the Baudó, I accidentally left it as a matter of inference, instead of making it one of direct assertion, that that pathway also was traced upon the same principle; and that ground some 200 feet lower appeared to us, at the time, to have been attainable for crossing the summit.

The peculiar configuration of the hill of Barro Blanco, is not confined exclusively to *it*, but characterizes several of the other short ranges shown on my map.

It will be observed, on referring to the "Route of Levels" attached to the map, that the waters of the Santa Mónica, and of the Creek of Citará, head close together. At this point, however, they are mere trick-

ling runs when there is no rain; although they afford from one to three feet of water during, or for a few hours after heavy falls.

Now, it is not only possible, but even quite probable, that a Cura, interested in the boating business, may have exercised sufficient influence over some of the gold hunting members of his flock, in the immediate vicinity of the spot, to induce them to cut down a few bushes, and hollow out a short gutter between some two similarly situated little runs on top of the ridge near the head of the Raspadúra; and such a ditch may have been used as part of a canoe-slide across the intervening eminence, until filled up again by the rain washes. That nothing more *was* done, is evident from Humboldt's remark that "when the rains are *abundant*, *canoes* loaded with cacao pass from sea to sea."

Precisely the same kind of canal could now be made by a dozen expert laborers, in a few days. But if done, it would be difficult to command the energy required to keep it open. A few months' rain would fill it with gravel; the people would shrug their shoulders, and pronounce it a case of "Dios lo quiere," (God wills it;) and the peones rejoicing in the failure of the innovation, would again strap their heavy burdens to their foreheads, and trudge along contented, according to the "costumbre del pais."

I was at San Pablo in 1852, or but 64 years after the date given to Humboldt as that at which the Cura's canal was dug; yet persons living near the spot, both before and ever since that period, told me they had never heard of it; nor did I meet with one, out of more than 50 persons familiar with the Raspadúra locality whom I interrogated on the subject, that had. This is not to be construed into a proof that no ditch was dug; but merely that it was a work of such entire insignificance as to create little or no impression even in a region where internal improvements are entirely unknown.

All, however, confirmed the statements made by my friends in Quibdó, and by my Indian peones, and supported by what very little I saw of the Raspadúra near its mouth, that that stream was both more rapid and more shallow than the Santa Mónica; and that the atravesia between its head waters and those of the little Quebráda leading to the San Juan, was higher than that across which I ran my line of levels. The best evidence of this fact, however, is afforded by the circumstance that the Raspadúra route has, for many years, been entirely superseded by that of the Santa Mónica, for both travel and transport.

The town of San Pablo contains about thirty houses or huts, one story in height, built chiefly of palm strips. Many of them are raised on stilts to avoid the freshets of the San Juan. Through the courtesy of Señor Abadia, one of the principal men of the place, we were accommodated with one belonging to him, and joining his own. Through the crevices between the rough palm strips of the partitions, we could see and hear, or rather, could not avoid seeing and hearing, all that transpired in the houses of our neighbors on both sides.

Our previous tropical experience, however, had thoroughly inured us to such things; and we could, consequently, dress and undress with the most stoical indifference, under a battery of a dozen brilliant black eyes manœuvred by inquisitive señoras and señoritas, equally black.

Our baggage boxes served for chairs and tables ; and our meals were prepared for us, and sent to our house by a señora store-keeper, with whom we had made an arrangement for that purpose. They were, however, generally handed over to our peones, as from the style of cooking, we found it impossible to eat them, so long as we had a reserve of sardines and crackers to fall back on.

In most of the houses small shops are kept, the scanty supplies of which, are chiefly brought from Carthagena, by way of Quibdó.

While the Pacific lines of British steamers touched at Buena Ventura, some little commercial intercourse was maintained between that point and San Pablo, by way of the San Juan. This, however, has now ceased, and the gold dust and platina, collected in the vicinity of San Pablo, now find their way chiefly to Carthagena, and thence to Europe and the United States, in payment of imported goods.

The collection of these metals employs, more or less directly, nearly all the inhabitants of San Pablo and the adjacent region.

The town stands on the east side of a small creek, about 100 feet wide, called the Quebrada of Citará, which here fluctuates generally between one and five feet in depth, depending on the duration of the constantly recurring showers. Every year there occur high freshets, which give it a depth of twelve or fourteen feet, rising to near the floors of the houses. Señor Abadia told us that about thirty years ago, a flood in the San Juan, aided by a simultaneous one in the Quebráda, raised the waters of the latter more than 20 feet above its bed, covering the floors of the houses to a depth of four or five feet.

On the opposite side of the creek is a hill, apparently nearly a hundred yards high.

Dr. Halsted made the latitude of San Pablo five degrees nine minutes north ; his opportunity lasted for but a quarter of an hour ; sufficing only for a single observation, and even it, he thought, might be in error some two or three minutes. I had no chance to observe for myself.

We were not at all annoyed by mosquitoes while at San Pablo ; and but little by hejenes, (or gnats.) Very few birds were seen in the neighborhood ; nor did we encounter a single wild quadruped, or a snake of any kind, although we passed and re-passed between San Pablo and the Santa Mónica several times.

The town itself appeared to be somewhat infested by a few of that loafing class, who regard time only as an essential element in smoking and lounging ; and who, having no business of their own to attend to, intrude themselves into that of others.

About a dozen of the most confirmed of these nuisances, some with and some without shirts, and of all ages and sizes, selected our room, doorway, and window, as their stand, as soon as we had installed ourselves ; and here they maintained their position from morning till night, during our entire stay, except when a shower would scatter them for a while. Although their visits were intended rather as complimentary than otherwise, we should have considered the custom much " more honored in the breach than in the observance."

We found the price of provisions to be very high here ; plantains were selling at two cents a-piece ; shelled corn for bollo (a kind of corn bread,

or more properly, a kind of corn putty,) at fifty cents an almoud (about twenty five pounds;) and other articles in proportion.

Such river floods as overtop the levees, frequently overthrow and destroy the crops of corn, and some other kinds of produce, not only along the San Juan, but also the Atrato, Baudó, &c.

There is no church in San Pablo, which is the only Granadian town I ever saw without one. The sabbath is here, as in all Catholic countries, devoted not only to religious observances, but also to recreation, visits, and amusements of every kind.

At San Pablo it is more especially marked by the arrivals of canoes loaded with produce from the negro ranchos along the levees of the San Juan. The proprietors of these usually avail themselves of the occasion to treat the females of their families with a shopping visit to the town; while they themselves engage in the nobler pursuits of drinking and cock-fighting. Although the stock of most of the shops comprises little more than half a dozen bottles of mata burro, a few handfulls of segars, and some three or four yards of coarse gaudy cotton handkerchiefs, yet some contain very fair assortments of such cheap crockery, dry goods, hardware, and groceries, as are in demand hereabouts.

Our line of levels (see Map) showed that the bed, or bottom, of the San Juan at San Pablo, was 103 feet below that of the Santa Mónica at the Tambo of San Pablo, or head of canoe navigation; and that the lowest intervening ground at the summit between the two is *about* 183 feet above the former, or 80 feet above the latter. I say *about*, in reference to the height of the summit, because our levels were actually taken along the pathway over the hill of Barro Blanco; and the depth of the depressions at the side of the hill was merely estimated by eye, inasmuch as its exact determination was a matter of no importance whatever in view of the great question at issue.

The highest point attained by the pathway over the summit of the hill itself, is 144 feet above the Santa Mónica, and 247 above the San Juan; and the depression at its side, where the sources of the two Quebrádas approach nearest together, appeared to be *about* 64 feet below the summit; which would make it *about* 80 feet above the Santa Mónica.

The width of the San Juan at San Pablo, we found to be 450 feet. The depth, at the time we sounded it, was just five feet for nearly the entire distance across; and the current in mid-channel, was three miles per hour.* The adjacent banks were from four to nine feet above the then stage of water, making the depression of the bed itself from 9 to 14 feet below the tops of the banks. This was almost precisely the same depth that we had found at the time of our first visit.

Sometimes, however, it becomes so reduced, that boys can readily wade across the river, as they do across the Atrato at Quibdó; while, on the other hand, in high floods, it overtops its levees some two or three feet, and inundates large tracts of back lands. This occurs every year, and generally, several times a year. From all I could learn, the *ordinary* depth in mid-channel at San Pablo, may be considered as ranging between five, and seven or eight feet.

* I suspect, however, that the velocity here would have been greater, had not a shoal existed a short distance below.

The bed of the river above, and for some leagues below the town, consists of large rounded paving pebbles of sienite, porphyry, and other primary rocks.

The reader is now possessed of the most prominent facts bearing upon this locality in reference to the construction of a canal.

To even the least initiated in engineering science, it must be self-evident that the idea of a ship canal cannot be entertained for a moment; while those better qualified to form an opinion on the subject, will, I doubt not, coincide with me in the assertion that the expenditure necessary to consummate a canal for steamboats of but six feet draft, could not be justified by any remunerating intercourse that could be anticipated between the two oceans by this route.

After the mineral riches of this region shall have gradually drawn together a new population of hardy and enterprising foreigners, (and this period, I venture to predict, is not very far distant,) then the necessity for a more regular medium of transport along the upper waters of the Atrato, and across the dividing grounds between them and the San Juan, will force itself upon those pioneers. Then we may expect that slight improvements, such as will afford an uninterrupted navigation of the streams by boats of some 18 inches, or two feet draft; and short connecting roads transitable by horses and wagons, (or by the loaded boats themselves, placed on wheels,) will be made. But to look beyond this period, demands the gift of prophetic inspiration.

It is to be regretted that, of the various representations that have been submitted to the public, as to the feasibility of the several inter-oceanic canal routes through this region, none have emanated from practical civil engineers. The authors of most of them, apparently, shelter themselves in the shadow of the illustrious Humboldt, and discard the evidence of their own senses, in favor of mistatements, however gross, innocently promulgated by that truly great man. Humboldt never visited any of these proposed routes, and is, therefore, no more qualified than any other person to advance arguments respecting them, requiring a personal acquaintance; nor has he pretended to do so.

I yield to none in veneration for the august name of Humboldt; but I must beg leave to enter my protest against the silly parade of it as authority, in cases in which he himself distinctly disavows all pretensions as such. The fact is, that his informants, as well as those of more recent date, have, either wilfully or through ignorance, slurred over difficulties, which, in the ordinary sense of the word, may be pronounced insurmountable. As a rule of almost universal application, the superficial observations of unprofessional travelers, have led to the propagation of erroneous ideas on all similar cases pertaining to the province of the Civil Engineer.

Among the principal difficulties to be encountered in the construction of even a canal for small boats, of say 3 feet draft, is, first, that the San Juan is 103 feet below the head of canoe navigation on the Santa Mónica; and that the lowest depression in the dividing ridge between the two streams is *about* 183 feet above the former, and *about* 80 feet above the latter. We therefore should have (on the most economical mode of proceeding,) 103 feet of lockage; in connexion with a long cut of some 80

or 90 feet in depth at the centre; and a reservoir for supplying the summit level.

Besides these, the Santa Mónica would require a good deal of improvement, as before hinted; as would also the upper portions of the San Pablo, before they would be available for a tolerably regular system of navigation by boats of even 3 feet draft.

Second;—The entire year may be regarded, practically, as one continuous rainy season. On this account, it would be altogether impossible to assign any limit to the period that would be required for the execution of the work; or to frame even an approximate estimate of its cost. Numberless secondary inconveniences attendant on this source will suggest themselves to an experienced engineer; especially those of sickness, and the impassable condition of the soil for vehicles employed in transporting stone, timber, &c., for construction.

It is well known that on the Panama railroad, the rainy season compels a comparative suspension of operations for nearly half the year; and the rains at the site of our canal, are fully as heavy as on the Isthmus of Panama; beside extending through the whole year. We also know that we may safely state the cost of the Panama railroad at not less than about five times as great as if it had been in the United States: and if we assume but the same proportion for our small boat canal, we shall arrive at an expenditure of about five millions of dollars.

The interest on this sum, in addition to the expense of annual repairs, lock-tenders, agents, &c., would equal, in amount, the entire value of all the merchandize that would probably pass through the canal in any one year for a long time to come; and consequently could not be repaid by any system of tolls that would be submitted to.

I cannot imagine that such a canal would ever form a highway *between the two oceans* for any travel or freight, beyond, perhaps, the persons and baggage of some few individuals, whom curiosity might prompt to select that route in preference to the Panama Railroad.

That road is, in my opinion, destined to remain for a long time the sole medium of ready transport between the Atlantic and Pacific.

From my description of the depths of the rivers on both sides of San Pablo, it is evident that a canal for steamboats of some six or seven feet draft, would be immensely more expensive than the small one which I have supposed, inasmuch as it would involve an extensive system of river improvements, the cost of which I cannot (under all the peculiar incidental difficulties of the case) pretend to estimate; nor, indeed, do I believe it to be susceptible of computation.

The result of my levels across the Isthmus of San Pablo having acted as a final extinguisher to my hopes of an inter-oceanic canal; I determined not to return to Quibdó after I should have explored the San Juan to the Pacific, as had been my intention hitherto; but from the mouth of that river to find my way back to the United States by way of Panama, as best I could. I therefore dropped a line to Mr. McCann, who was still in Quibdó, and requested him to return to Carthagena, and await me there. Our Patron and peones were not apprized of the change, lest they might decline to accompany us down the San Juan if they knew of it.

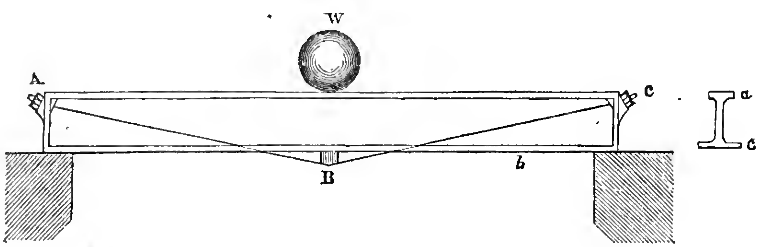
(To be Continued.)

*On Compound or Trussed Cast Iron Beams or Girders.** By W. Fairbairn, C. E., F. R. S. &c., &c.†

In a Government Report several important facts were recorded, bearing directly upon the dangerous nature of trussed girders, or that description of girders where attempts are made to increase their strength, and to maintain them in form, by the use of wrought iron bars fastened at the upper ends, and acting in a diagonal direction on the bottom of the beam. Of the safety of these tension-rods I have always had serious apprehensions; but as many other persons, of highly distinguished attainments, hold a different opinion, it may not be considered irrelevant if I adduce my reasons for the view which I take, and the experiments upon which those reasons are founded.

If we take a cast iron beam of the section of greatest strength, and endeavor, by means of truss-rods, similar to A B C in the following sketch, to increase its powers of resistance, we shall find that under certain circumstances, they introduce an antagonistic force, which has an injurious influence; or that, in other words, the beam would be safer without the truss-rods than with them.

To some, this may appear paradoxical; but in order to ascertain how far the statement is entitled to credit, let us assume the flanches, *a*, *a*, fig. 1, to be one-sixth of the area of the flanch, *b*, *b*; ‡ and under the



impression of still further adding to its strength, let us suppose that two truss-rods, A, B, B, C, are applied one on each side of the beam, to assist in supporting the weight W.

Experimentalists having found that wrought iron possesses great powers of resistance to extension, while cast iron presents great powers of resistance to compression, it became a matter of inquiry how far, and under what circumstances, cast iron and wrought iron might be employed together in the construction of beams, so as to embrace the advantages arising from these peculiar properties of the two materials. This inquiry gave rise to the construction of truss-beams, where the

* "*On the Application of Cast and Wrought Iron to Building Purposes.* By W. Fairbairn, C. E., F. R. S., &c., &c. London: Js Weale, 1854.

† From the London Artizan, March 1854.

‡ These proportions are found by experiment to constitute the strongest sectional form. See Mr. Hodgkinson's Experiments, *Manchester Memoirs*, Vol. v., Second Series.

wrought iron is solely employed to give strength to the bottom part of the beams by its tensile resistance, while the cast iron in the top part of the beams is solely employed to resist the force of compression. Now, if a truss-beam could be constructed so that the two materials might be brought to act in perfect concert with each other, this contrivance would, no doubt, effect a considerable economy of material; but we shall hereafter show that this is impracticable.

In a perfect truss-beam (supposing it possible to have such a thing) the cast metal should be upon the point of rupture at the same moment that the truss-rods are about to yield to extension. If too great a tension is given to the rods, they will break before the beam has arrived at the condition of rupture; on the contrary, if too small a tension is given to them, the beam will break before they have arrived at their condition of rupture. In absence of exact data, we should say, in order to avoid danger, that the tension of the truss-rods had better be too low than too high; for in the former case they would yield up a portion of their tensile resistance, and then leave the remaining portion of the load to be borne by the beam itself. Experiment I., shows the difficulty of adjusting the tension of the truss-rods; for in this case they yielded to extension, and and then the beam broke with a weight which it would have nearly sustained by its own resisting powers. In order to discover the best tension for truss-rods, it is necessary that we should consider more minutely the distinctive properties of the two metals composing the truss-beam.

The two kinds of material are very different in their physical as well as in their mechanical properties. *Cast iron* is a hard, rigid, crystalline, unmalleable substance, which presents a great resistance to a force of compression, but a comparatively small resistance to that of extension; and from its low degree of ductility, it undergoes but little elongation when acted upon by a tensile force. On the contrary, *wrought iron* is a flexible, malleable, ductile substance, which presents a great resistance to a force of extension, but a somewhat less resistance to that of compression: from its high degree of ductility, it undergoes a considerable elongation when acted upon by a tensile force. When the two metals are released from the action of the tensile force, the SET of the one metal differs widely from the SET of the other. The flexibility of wrought iron is from eight to ten times greater than that of cast iron. Under the same increase of temperature the expansion of wrought iron is considerably greater than that of cast iron. While wrought iron yields to a stroke, cast iron is readily broken by a severe collision, or by any violent vibratory action.

The following generalizations of an extensive series of experiments will give an exact comparative view of these properties of cast iron and wrought iron:

Table I.—*Mean elongations by tensile forces within the limits requisite to rupture cast iron, viz: about $7\frac{1}{2}$ tons per square inch of the transverse section.*

Name of the metal.	Mean elongation, the force being 1 ton per square inch.	Proportion of elongation.	Sets with 7 tons per square inch.
Cast iron,	$\frac{1}{5450}$ part of the whole length of the bar, . . .	$2\frac{1}{4} : 1$	$\frac{1}{7}$ of the whole elongation.
Wrought iron,	$\frac{1}{12300}$ part of the whole length of the bar, . . .		$\frac{1}{112}$ of the whole elongation.

From this table it appears, that for forces of extension below $7\frac{1}{2}$ tons per square inch, the mean elongation of cast iron is about $2\frac{1}{4}$ times that of wrought iron. When the cast iron is about to undergo rupture, its ultimate extension is about 3 times that of the wrought iron. Moreover, the set of the cast iron, within this limit, is considerably greater than that of the wrought iron.

Table II.—*Mean elongations and sets, with tensile forces equal to two-thirds of the forces requisite to produce rupture in each case respectively.*

Name of the metal.	Force per sq. in. in tons.	Elongation on 10 feet of the bar, in inches.	Proportions of elongations.	Set.	Proportions of sets.	Proportions of sets to elongation.
Cast iron,	5	·114	$1 : 2\frac{2}{5}$	·013	1 : 10	$\frac{1}{9}$
Wrought iron,	15	·275		·133		$\frac{1}{2}$

From this table it appears, that when the parts of the truss-beam are duly loaded, the conditions are reversed; that is to say, the elongation of the wrought iron becomes $2\frac{2}{5}$ times that of the cast iron, and the set of the former becomes 10 times that of the latter.

Table III.—*Mean values of the tensile forces requisite for producing equal elongations in cast iron and wrought iron bars* 10 *feet long, with the corresponding sets.*

Mean elongations on 10 feet in inches.	Cast iron. Force per sq. in. in tons.	Wrought iron. Force per sq. in. in tons.	Cast iron. Set in inches.	Wrought iron. Set in inches.
·005	·26	·56		
·024	1·11	2·5	·0012	Not perceptible.
·040	2·	4·5	·0031	·0005
·050	2·5	5·6	·0043	·0007
·062	3·	6·76	·0056	·0009
·087	4·	9·	·0090	·0027
·129	5·5	12·4	·0159	·0140
·145	5·9	13·26	·0190	·0430

This table establishes the following remarkable law relative to the forces requisite for producing equal elongations in cast iron and wrought iron bars. Within the limit of 6 tons tensile strain per square inch for cast iron, and $13\frac{1}{2}$ tons for wrought iron, the tensile force applied to wrought iron must be $2\frac{1}{4}$ times the tensile force applied to cast iron, in order to produce equal elongations.

(To be Continued.)

AMERICAN PATENTS.

List of American Patents which issued from July 11th, to Aug. 1st, 1854, (inclusive,) with Exemplifications by Charles M. Keller, *late Chief Examiner of Patents in the U. S. Patent Office.*

JULY 11.

81. For an *Improvement in Machines for Carving Marble, Stone, &c.;* William J. Casselman, Assignor to Elias A. Swan, Vernon, New York.

Claim.—"1st, I claim the means for carving or cutting marble or other material, consisting of the adjustable or movable blocks or patterns on a revolving wheel or wheels, for determining the position of the cutting tool or tools, either horizontally or vertically, in combination with a revolving or reciprocating bed. 2d, Communicating motion from a pattern wheel or wheels, constructed with movable or adjustable patterns, both on the circumference and on the sides, to the sliding tool or tools, by means of levers so set and operating as to place said tools in the required position as the parts move, as specified. 3d, I claim constructing a cutting tool or tools for carving marble or similar substances, with blades or tools attached to the bottom and side of the stock, which stock is so fitted as to receive a rotary motion, to operate as specified."

82. For an *Improvement in Machines for Pegging Boots and Shoes;* A. C. Gallahue, City of New York.

Claim.—"I do not claim the employment or use of the rocking bed plate, when such bed plate is attached to a movable carriage, as described, for the purpose of causing the edge of the sole of the boot or shoe to bear against the gauge block as the carriage is moved, without the intervention of a pattern or cam."

83. For a *Machine for Making the Heads of Shovel Handles;* R. D. Bartlett, Bangor, Maine.

Claim.—"I claim to so construct the dished wheel and its cutters, and apply them together, in combination with so constructing the bearing rest with a shelf and bearer plate, or equivalent contrivance, and applying it to the wheel, so as to cause it to extend within the wheel, and enable a person to introduce the shovel head into it, and between it and the inner surface of the wheel, and support said shovel head and turn it against the cutters, so as to cut it curved in two directions."

84. For an *Improvement in Lanterns;* Andrew Lanergan, Boston, Massachusetts.

Claim.—"I claim the combining with the lantern, the mouth tube, so as to enable a person to put out the flame of the lamp."

85. For an *Improvement in Construction of Iron Houses;* C. Mettam, City of N. Y.

Claim.—"I claim the combination of the chairs with the breast summers and the columns, substantially in the manner set forth."

86. For an *Improved Grapnel for Raising Sunken Vessels;* J. T. Martin, City of N. Y.

Claim.—"I claim the combination of the plates, levers, and iron bars, with the timber, constructed to form a marine grapnel to be used in the raising of sunken vessels."

87. For an *Improved Mode of Constructing Metallic Roofing;* Henry Outcall, Wilmington, Ohio.

Claim.—"I claim scrolling the edges of metallic plates, so as to form a tube or cylinder, and then connecting their edges by means of other scrolls, which are formed also into tubes on the edges of a narrow strip of the same kind of plate, and being somewhat larger than the former tube or scroll, so that they will slide over and fit snugly to it for subserving three different purposes, viz: first, for protecting the roof against injury from contraction and expansion; second, for preventing the water from driving through the roofing at the scrolls; third, for supporting the roof and all superfluous weight that may accumulate, such as snow, &c., without any superstructure other than those on which its end rests."

88. For *Improved Arrangement of Means for Freeing Canal Boats from Water;* W. Loughridge, Weverton, Maryland.

Claim.—"I claim the arrangement of float, valve, and bent tube in the bottom of the boat, by which the discharge of water is rendered automatic, and the boat freed from leakage."

89. For an *Improvement in Operating Cut-off Valves of Steam Engines;* Wm. Lowe, Hartford, Connecticut.

Claim.—"I claim the double rock shaft, one passing through the other, the outer shaft to work the catches and exhaust valves, and the inner shaft actuated by the catches to open and close the valves to effect the cutting off the steam, in combination with the other parts of the mechanical movements, or their equivalents."

90. For *Elevated Ovens;* James C. Kennedy, Albany, New York.

Claim.—"I claim the combination of two or more ovens in the elevated oven chamber or shell, with flues for hot air between each end of the chamber and one of the ovens; also, with a flue between each oven, all the flues being provided with regulating dampers for the proper management of said oven and flues."

91. For an *Improved Impact Water Wheel;* Abel Greenleaf, Kingston, Penna.

Claim.—"I claim the combination of the horizontal buckets with the vertical buckets, substantially in the manner described."

92. For an *Improvement in Apparatus for Sealing Cans;* Joel Green, Cincinnati, O.

Claim.—"I claim, 1st, The application of a steam jacket, coil, or equivalent device, to an exhausted receiver, in connexion with soldering apparatus, for the purpose of sealing or soldering preserving canisters, &c., under the combined agencies of heat and vacuum, for the purposes explained. 2d, The combined ball, and sliding and air-tight joint of the rod, as described, permitting the heating, insertion, and the vibratory longitudinal and revolving motion of the soldering bit, while excluding the external atmosphere, for the purpose of soldering in vacuo, as explained, and enabling the direct application of the heated bit, without the intervention of any other substance."

93. For an *Improvement in Lifting Jacks;* R. W. Genung, Blooming Grove, N. York.

Claim.—"I claim making the lever capable of being adjusted so as to be thrown in and out of contact with the rack bar with facility and ease, and retaining it securely in its place after being adjusted, by providing the bearings with a curved slot and two semicircular fulcrum rests."

94. For an *Improvement in Oil or Blubber Presses;* Wm. P. Chadwick, Edgartown, Massachusetts.

Claim.—"I claim the arrangement of the screw within the body of the box, in connexion with fixing it firmly and immovably to the platen, and so applying to it and one end or the bottom of the box, as described, a rotary screw nut and a set of gears and a crank shaft, that by revolution of the screw nut the platen will be forced towards the top, or other end of the box, the said arrangement and application of the power that operates the platen enabling me to make a much more compact, efficient, and desirable blubber press for ships' use, than that heretofore patented by me."

95. For an *Improved Valvular Arrangement for Diaphragm Pumps;* Stillman A. Clemens, Springfield, Massachusetts.

Claim.—"I claim the mode of constructing and operating the valve, in combination with flexible diaphragms, to wit: the valvular openings being in the diaphragm itself, or in a part of the diaphragm, and the valve being attached to and worked by the piston in such manner that the diaphragm shall move to and from the fixed valve, and close and open the holes in the diaphragm valve."

96. For an *Improvement in Machines for Stretching Shoes;* A Burwell, Rochester, N. Y.

Claim.—"I claim the construction and use of lasts to be operated by two independent screws, in such a manner as to be able to stretch the shoe or boot at the instep or toe, at pleasure. Also, the expanding plates with their projecting pieces of metal applied, operated by the wedge or cone pointed screw."

97. For an *Improvement in Hat Shapers;* Adolph and Felix Brown, City of N. York.

Claim.—"We claim the application of the movable pieces with their set screws working in a groove made in the segments, or the equivalent thereof, and bearing against any desirable point of a flexible plate fitted round the outside, giving, thereby, the same any desirable shape."

98. For an *Improvement in Lifting Jacks;* F. B. Smith, Craigsville, New York.

Claim.—"I do not claim the oblong slot, separately, for the purpose of allowing the lever to be adjusted so as to let the bar fall; but I claim the curved oblong slots, in combination with the double-acting pawl and tooth on the lever, so that the lever may be adjusted, and after being adjusted, prevented from again falling and coming in contact with the rack bar, before it has entirely descended."

99. For an *Improvement in Taking Daguerreotypes for Stereoscopes;* Albert S. Southworth and Josiah J. Hawes, Boston, Massachusetts.

Claim.—"We claim the within described method of taking stereoscopic pictures, in which the two positions of the camera are upon a line, making an angle of 45° with the horizon."

100. For an *Improvement in Bedstead Fastenings;* R. H. St. John, Columbus, Ohio.

Claim.—"I claim the clevis clamp, together with the double mortise post, in combination with the key or wedge, through all of which is produced a compensating bedstead fastening."

101. For an *Improved Chain Hook;* Willis Straw, Dalton, New Hampshire.

Claim.—"I claim the 'iron guard,' and the manner of attaching it to the hook."

102. For an *Improved Mode of Ringing Bells by Steam;* G. B. Snow, Buffalo, N. Y.

Claim.—"I claim the manner described of ringing the bell by the application of steam power, and the gravity and momentum of the bell combined by means of the direct acting engine, attached by a chain, or other equivalent mechanical device, to the bell, and arranged, combined, and operating with the bell, as specified, and so that the bell is swung in one direction by the engine, and then set loose or free to swing back in the opposite direction by its own gravity and momentum, to produce the ring or sound, and the steam alternately admitted to and exhausted from the engine by the action of the engine and movement of the bell combined, substantially as specified, and whereby the same freedom in the swing of the bell to produce a long and clear sound, as is produced by the ordinary manual process, but with greater regularity and consequent increased clearness of note, is automatically obtained."

103. For an *Improvement in Screw Wrenches;* Jabez C. Terry, Springfield, Mass.

Claim.—"I claim attaching the shank of the inner and stationary jaw to the handle, by means of straps, or their equivalents, attached to the lower end of said shank, said straps passing through the screw nut and into the handle, and having grooves or recesses in them, which, when the straps or handle are turned, receive projections on the top of the handle."

104. For an *Improvement in Mills for Grinding;* T. B. Woodward, Kingston, Penna.

Claim.—"I claim the combination and arrangement of one or more cylindrical bruising or grinding nuts and chambers or cylinders with the stones of the mill, in such manner that the relative distance of the stones to each other may be varied without increasing or diminishing the distance of the acting surfaces of the nuts and cylinders."

105. For an *Improvement in Brakes for Light Vehicles;* M. D. Wells, Morgantown, Va.

Claim.—"I do not claim the employment of spiral or other springs to draw the rubbers to the wheel; nor do I claim any of the devices embraced in the patent of Elijah Chapman, September 26, 1846, or the rejected applications of G. Newcomer and J. M. Ewing; but what I claim is, the combination of the two systems of springs, and with the rods and levers, for so operating the brake bar that the movement of the levers, within certain limits, shall have no action on said bar."

106. For an *Improved Mode of Manufacturing Iron Slats for Window Blinds;* Wm. E. Ward, Port Chester, New York.

Claim.—"I claim the manufacture of Venetian blind slats made of sheet iron, of two thicknesses in one piece, with both edges bent entirely over, the two halves of the width

bent or curved in opposite directions, and with a semi-circular head on each face, inclosing a wire, the ends of which form journals."

107. For an *Improvement in Flouring and Bolting;* John Stouffer, Peter Brough, and John W. Barr, Chambersburg, Pennsylvania.

Claim.—"We claim the arrangement of the bolts and pipes, screw conveyor, and spout, by means of which the specky flour, first passing through the upper bolt, is rebolted by being mixed with the stuffs (containing the bran,) as received from the main burrs, by which the quantity of superfine flour is increased, while the quality or brand is maintained, substantially in the manner set forth."

108. For an *Improvement in Machinery for Making Pasteboard;* Orin W. Fiske, Dedham, Massachusetts.

Claim.—"I claim the combination and arrangement of the cylindric paste brushes with three rolls or beams of paper, and compressing and draft rolls, whereby the two cylindric brushes are made to apply at one operation, the paste to the underside of the upper strip of paper, the two sides of the middle strip, and the upper side of the lower strip, all as set forth."

109. For an *Improved Pen and Pencil Case;* Jacob J. Hatcher, Philadelphia, Penna.

Claim.—"I claim, 1st, The permanent attachment of the pencil to the case, operating by the tube sliding over the pencil. Also, the hollow reserve for leads, with the pen holder working over and around the ever point."

110. For an *Improved Iron Picket Fence;* Mathew Walker, Sr., Philadelphia, Penna.

Claim—"I claim the mode of making wrought iron fence, the same consisting in a compound rail composed of two bars of wrought iron corrugated by dies, so that the bars shall embrace the posts or banisters at the proper intervals, and between the same have their inner surfaces in contact, so as to be riveted up close and make a firm and neat fence."

JULY 18.

111. For an *Improved Steam Boiler;* W. E. Bird, Cahawba, Alabama.

Claim.—"I claim the combination of the lower boilers or boiler, and the upper boilers or boiler, with each other and with the furnace, in such a manner that the top of the furnace will be formed of the upper boilers or boiler, and the rear of the furnace be principally formed of the lower boilers or boiler, while the flue space from the said furnace passes between the said upper and lower boilers, and communicates with the flues returning through the lower boiler or boilers, substantially as set forth."

112. For an *Improvement in Cotton Gin Ribs;* Israel F. Brown, Columbus, Georgia.

Claim.—"I claim the employment of a series of cast iron hubs, each having two or more arms cast with them, each of which arms is of proper form to combine with a short rib, and with it form a complete rib, whereby, when the said hubs are secured upon a shaft, arranged in a proper position, their arms may be successively brought into combination with the short ribs, for the purpose of removing the wearing parts, substantially as described."

113. For an *Improvement in Machines for Preparing Flocks for Felting;* Leander W. Boynton, South Coventry, Connecticut.

Claim.—"I am aware that brushes have been used for preparing flock and analogous substances, and that the use of a wire screen is not new; I therefore do not claim either of them, as such; but I claim the combination of a wire screen with a revolving cylindrical brush and one or more stationary brushes, when the screen is placed below the revolving brush, to prevent any of the flock from falling on to the web of wool before it is fully prepared, and also to assist in preparing the flock, when the whole is constructed, substantially as described."

114. For a *Method of Coating Iron with Brass or Copper;* Hugh Burgess, Kentish Town, England; patented in England, February 17, 1853.

Claim.—"The coating of iron sheets, bars, bolts, and other forms of iron with copper or brass, by a combination of processes, as follows: by first cleaning, then coating them over with a solution of cadmium or zinc, drying and dipping them into a bath of

melted copper or brass, and raising them out of the bath into an atmosphere of steam and carbonic acid, flowing in streams or in jets, as described."

115. For an *Improvement in Block Slide Valves for Steam Engines;* Lewis R. Conard, Philadelphia, Pennsylvania.

Claim.—"I claim forming the passages through said valve, so that the oblong steam and exhaust openings shall enter from the upper and lower surfaces, longitudinally to its motion, and leave the opposite surfaces transversely thereto."

116. For an *Improved Method of Making Printing Blocks;* T. Crossley, Boston, Mass.

Claim.—"I do not claim the use of gutta percha as a material for making printing blocks; neither do I claim sawing blocks into prisms, for the purpose of more easily removing those portions of the block not required for the figure; but I do claim the method of making printing blocks, the surface of gutta percha being applied to the surface of the wood, in the manner set forth."

117. For an *Improvement in Bridges;* Samuel Champion and Thomas Champion, Washington, D. C.

Claim.—"We claim, 1st, The combination of tubular braces or struts, made smaller by gradation, or tapering as they extend from the pier or support, with suspension rods also made smaller by gradations, or tapering as they extend from their pier or support. Also, the arrangement described, of the struts, suspension rods, and clamp posts, viz: the oblique struts between the centre post and horizontal strut being placed in lines radiating from a common centre, and the suspension rods being also placed in lines radiating from a common centre, above that from which the struts radiate, in such manner that each suspension rod shall extend from the top of the column or post over the pier or support, to the foot of one of the clamp posts, while each oblique strut shall extend from the foot of the post over the pier, to the head of each clamp post. We also claim the construction of tapering tubular struts of bridges of not less than two concentric sheets, layers, or thicknesses of metal, the sheets of each layer abutting, and those of one layer breaking joints with the next."

118. For an *Improved Mode of Operating Excavating Machines;* Joel A. H. Ellis and Alexander Gordon, Rochester, New York.

Claim.—"We claim, 1st, The placing of the excavating machine within the circuit of an endless chain which passes over a pulley anchored at one point, and over or around a capstan at another point, so that the excavator shall form a part of the endless chain, and be drawn forward or backward, and operated by it. Also, attaching one or both ends of the chain to a drum or shaft connected with the machine, so that the slack of the chain may be taken up on said drum or pulley shaft, to cause the machine to move steadily without sudden strain, or to let out the chain when it becomes necessary to draw it out of its direct line for guiding the machine in any desired direction."

119. For an *Improved Windmill;* Jacob Erdle, West Bloomfield, New York.

Claim.—"I claim the manner or mode of filling the whole wheel with fans or wings, which causes the wheel to be more powerful than it otherwise could be, as it receives the power from the whole current of air that strikes within its circle, and the mode or form of regulating, stopping, and starting the wheel through the centre of the main shaft."

120. For an *Improvement in Tanning;* Roswell Enos, Woodstock, Illinois.

Claim.—"I claim commencing the tanning operation upon the sides, by the use of a salted infusion of sumac, and then completing said tanning operation by the repeated use of the strong oak or hemlock bark liquors."

121. For a *Process for Separating Impalpable Powder for Paints;* Geo. W. Griswold, Carbondale, Pennsylvania.

Claim.—"I claim the process of separating and collecting impalpable from coarser substances, such as ground coal, for the purpose of paint or other mineral substances, by means substantially as described."

122. For an *Improved Mode of Raising Vessels;* Felix Huston, New Orleans, La.

Claim.—"I am fully aware that auxiliary floats to raise vessels have been used, some of which have been so geared as to be rotated for winding up the raising lines or chains; and that levers and weights have been used in connexion with dry docks for raising

vessels in said docks; these I do not claim; but I claim the raising of sunken vessels by means of the careening motion of the side or auxiliary vessels, whether such careening motion is procured by weights run across the decks from side to side of said vessel, or aided by arms projecting beyond said sides."

123. For an *Improvement in Horse Powers;* Wm. R. Palmer, Elizabeth City, N. C.

Claim.—"I claim the combination of the rib or projection upon the arms with the bent pin or iron, or their equivalents, constructed and arranged for the purpose of giving a short bend to the rope or band, and thereby preventing the slipping thereof."

124. For an *Improvement in Machines for Scouring Piece Goods;* J. Augustus Roth and Joseph Lea, Philadelphia, Pennsylvania; patented in England, Feb. 7, 1854.

Claim.—"Our improvement consists in an arrangement of rollers and of revolving dashers, in combination with a vat, whereby several continuous layers of cloth can be simultaneously passed through and acted upon by the water, thus effecting an economy in time and room, and securing a more thorough washing of the material. We claim the combination of the series of distributing rollers and the dasher wheels with the vat."

125. For an *Improvement in Cutting Tobacco;* Ebenezer Murdock, Albany, N. Y.

Claim.—"I claim the process of manufacturing cut tobacco, by mixing with the leaves as stripped of the stems for cutting, the stems previously cut up to a certain degree of fineness, (the object being to facilitate, by the use of said stems, the advantageous cutting of the leaf itself,) the mixed mass then to be cut up together to the requisite fineness, and then the stems to be separated from the cut leaf, which is then ready for use."

126. For *Manufacture of Lampblack;* William G. W. Jaeger, Baltimore, Maryland.

Claim.—"I claim the division of the house lengthwise, with the aperture and the connexion of the two houses by the chambers marked, by which I am enabled to carry the smoke around the whole length of the house, and return it, by means whereof a superior quality and a greater quantity of lampblack is condensed. Also, the use of the two furnaces, in the mode described, by which the manufacture can be carried on uninterruptedly. Also, the waste chimneys that open some distance below the roof, in the manner set forth."

127. For an *Improvement in Hermetical Sealing;* James Spratt, Cincinnati, Ohio.

Claim.—"I do not claim the gasket and screw, nor the wax trough, separately considered; but I claim the screw cap or cover and neck, provided with a gasket of gum elastic (or like substance) at their inner junction, when this is combined with a trough for containing cement around their outer junction, for the hermetical sealing or closing of preserve canisters."

128. For an *Improvement in Steam Gauges;* T. Stubblefield, Columbus, Georgia.

Claim.—"I claim the combination of the hollow cylindrical box, perforated at both ends with a hollow cylinder of india rubber, open at one end and performing the duty of manometer spring, and also separating the perforations in the opposite ends of the box; the several parts being constructed and arranged, and the case connected with the boiler, and the india rubber with the index, as set forth."

129. For an *Improvement in Washing Machines;* H. C. Stevenson, Georgetown, Ky.

Claim.—"I claim the arms and the springs, in combination with the rubber and plate, constructed in the manner described."

130. For an *Improvement in Weavers' Heddles;* Jacob Senneff, Philadelphia, Pa.

Claim.—"I claim forming the eye of the heddle, by casting or otherwise securing around and between the strands or threads composing the same, metallic clasps in lieu of the cumbersome knots heretofore employed, curved on their sides and made concave and smooth on their ends between the strands or threads where they form the ends of the eyes, in the manner set forth."

131. For an *Improvement in Buckles;* Wm. W. Smith, Marshall, Michigan.

Claim.—"I claim the stationary hook or tongue attached to the body of the buckle, as an improvement on the old or loose tongue and buckle, not only in the cheapness of manufacturing them, but in their strength and durability, and the ease with which they are or can be buckled and unbuckled."

132. For an *Improvement in Railroad Car Trucks;* A. Snyder, Hawley, Penna.

Claim.—"I claim making the bearing surfaces of the disks on which the load swivels, and is supported, of an undulating form."

133. For an *Improved Process for Making Steel Direct from the Ore;* Geo. H. Smith, M. D., Rochester, New York.

Claim.—"I claim the process of converting the iron ores, known as the oxides and carbonates, directly into steel, by subjecting the ore in the comminuted state with carbon, and with or without other flux, in a close oven, retort, or other vessel, to a high degree of heat, say about the temperature of what is known as 'white heat,' and then separating the metallic particles from the impurities, and either melting them in crucibles to produce cast steel, or welding and balling them in a reheating furnace, and subjecting the mass to pressure by rolling or hammering to produce spring steel."

134. For an *Improvement in Laying off the Scye in Cutting Garments;* Peter Spilman, Richmond, Va.

Claim.—"I do not claim the laying down of lines on a diagram for determining points of the arm holes of coats, considered irrespective of the precise manner in which these lines are placed, relatively, for I know that diagrams with lines on them, but differing entirely from those which I have invented, have heretofore been made; but I claim the apparatus, consisting of the diagram in the drawings, constructed and operating in the manner described."

135. For an *Improvement in Metallic Fire Places;* John F. Snyder, Culpepper, Va.

Claim.—"I claim forming the screen with narrow metallic strips, having a concave surface, connected by links, making them flexible, and easily coiled into a small space on a cylinder."

136. For a *Machine for Holding Docks of Horses;* Seymour Tomlinson, Pleasant Valley, New York.

Claim.—"I claim the stuffed section or pads, or their equivalents, so constructed as to support the tail of the animal in the required position by its sides, and the hair upon the sides so as to leave the cut, pricked, or scarified portions untouched, thereby permitting them to heal much sooner than if the fixtures which support the tail came in contact with them. Not intending to claim any of the other parts described or represented."

137. For an *Improvement in Winding Rope, Cord, or Yarn;* Philos B. Tyler, Springfield, Massachusetts.

Claim.—"I claim the combination of the friction brake, operated as described, and the sliding belt, or its equivalent. Also, driving the reel by its outer periphery, by the employment of the finger or dog herein described, in combination with the guide, for causing the reel to traverse, the reduction of friction caused by the mode of driving enabling the guide to cause the reel to traverse without too much resistance."

138. For an *Improvement in the Manufacture of Paper from Wood;* Charles Watt, London, and Hugh Burgess, City of London, England; patented in England, August 19, 1853.

Claim.—"We do not confine our claim to the apparatus or utensils, or the manipulations herein named. as they may be varied to suit the circumstances of the case; what we claim is, the pulping and disintegrating of shavings of wood, and other similar vegetable matter, for making paper, by treating them with caustic alkali, chlorine simply, or its compound, with oxygen and alkali, in the order substantially as described."

139. For an *Improvement in Machines for Threading Screws;* George Francis Wilson, Providence, and James Monroe Whitney, North Providence, R. Island; patented in England, April 4th, 1854.

Claim.—"We do not claim the use of a gang or series of cutters, which are allowed to return after each operation, and previous to making a new cut, as this has has been done before; but we do claim arranging the cutters upon the periphery of a disk, or its equivalent, and bring them up to the blanks by a continuous motion, in the manner described. Also, the peculiar manner in which the chasers are made and secured to the cutter head, they being let into grooves or recesses in the head, and having their upper portions hinged to their lower portions, which latter are secured to the head by screws, or otherwise, by which arrangement, while the chasers are held secure from all possibility

of displacement, they may be easily and expeditiously brought up to their work, as required."

140. For *Improved Carriage Springs for Light Vehicles;* Mary Burns, Administratrix of Robert Burns, Jr., deceased, late of the City of New York; patented in England, June 7, 1853.

Claim.—"I claim the combination of india rubber, or other compressible material, with a bar spring having a toggle joint in its centre. Also, the lengthening and shortening of the toggle joint bar between the compressible spring, by means of the screw or nut, by which they are made to sustain their required weight with a proper degree of elasticity, having greater or less stiffness in the spring bracing of the carriage."

141. For an *Improvement in Machines for Pegging Boots and Shoes;* George J. Wardwell, Andover, Maine, Assignor to himself and E. Townsend, Boston, Mass.

Claim.—"I do not claim the combination of a guide point with a set screw to regulate the distance of the pegs from each other; but I claim the combination and arrangement of the guide with the setting point with the handle, the awl or hole punch, the peg driving orifice and mechanism. Also, the combination and arrangement of the spring gauge, lever, or depressor, and the screw, with the handle and peg wood carrier, the object of the same being not only to gauge the space in the peg wood carrier so as to adapt it to peg wood of any desirable width below the maximum that can be used therein, but also to enable a person to move the peg wood downwards, and back of and below the edge of the knife when necessary, so that it may not be moved forwards, under circumstances as before stated. Also, the so combining the spring with the peg wood carrier, peg driver, and gauge lever, that it shall not only serve to support the peg wood, or constitute a bottom to the carrier, but also to force up the peg wood after it has been depressed, either by the peg driver or the gauge lever."

142. For an *Improvement in Machines for Sawing Stone and Marble;* A. H. Tingley, Assignor to himself, E. W., and Hervey F. Tingley, Providence, Rhode Island.

Claim.—"I claim the combination of the two spring pawls, their slotted connecting rod, the movable ratchet, and its tripping pin, with the fixed ratchet of the shaft of the spocket wheel, the whole being operated and made to operate together. Also, the series of hooked pins on the water distributor, in combination with the series of notches applied to the connecting rod for operating the water distributor, the whole being for the purpose of regulating the motion of the water distributor, and of causing that motion to take place over either a portion or the whole entire surface of the stone, as occasion may require."

JULY 25.

143. For an *Improvement in Mail Bag Labels;* Solomon Andrews, Perth Amboy, N. J.

"The nature of my invention consists in the formation of a label, by joining together two pieces of raised metal, or other suitable material, having the superscriptions on the convex sides, and open at both ends so as to admit a strap or chain to pass through it, and capable of being reversed. I disclaim a hinge, or any other adaptation to motion of the two parts of the label upon each other. Also, the stamping of the two sides of the strap, as in ordinary mail bags."

Claim.—"What I claim is, a label formed of two distinct parts, and riveted or firmly secured together, having the superscription on the outside, and open at both ends to admit a chain or strap to pass through it."

144. For an *Improved Device in Machines for Cutting Round Tenons;* Thomas R. Bailey and George Bailey, Lockport, New York.

Claim.—"We claim the arrangement of the tube, exterior to and concentric with the cutting tube, so that the rail may be steadied during the operation of the machine, and the tenon so cut that its axis shall be coincident with the axis of the rail."

145. For an *Improved Method of Securing Helves in Axes, etc.;* Horatio N. Bill and Jeremiah C. Bill, Willimantic, Connecticut.

Claim.—"We claim the peculiar shape of the eye of the axe, in combination with the helve and wedge."

146. For an *Improvement in Nutmeg Graters;* William Bradley, Lynn, Mass.

Claim.—"I claim the combination of the box or holder and its pressure spring with the rasping surface of the grater, when the whole are applied and made to operate together."

147. For an *Improvement in Looms;* Edward W. Brown, Fall River, Mass.

Claim.—"I do not claim the employment of two ratchet wheels upon the same shaft, with teeth in reverse directions, and which are actuated by separate and independent pawls driven by independent machinery; but what I do claim is, the combination of a single pattern chain, and the double acting pawls with the two ratchet wheels upon the cam shaft, for the purpose of driving the latter in either direction, as may be required. 2d, The combination of the ratchet wheels upon the cam shaft, the gearing, and the cam."

148. For an *Improvement in Bottles;* Reinhold Boeklen, Jersey City, New Jersey, and Henry T. Brown, Brooklyn, New York.

Claim.—"I claim constructing the bottle with an oblique cork or stopper passage extending from the mouth downwards through the neck, in such manner that while the lateral pressure on the cork is preserved, the cork passage in no way interferes with or obstructs the straight or direct communication through the mouth and neck of the bottle into the interior thereof."

149. For an *Improvement in Lamp Fastenings;* Lewis B. Carpenter, Buffalo, N. Y.

Claim.—"I claim the combination of the spring with the levers, having the pins or studs which work through the holes into a slot or groove."

150. For an *Improvement in Cotton Gins;* Lewis S. Chichester, Brooklyn, New York.

Claim.—"I claim the mode of operation of the vibrating curved surfaces, for the purpose of forcing seed out of the pods of cotton. Also, in combination, making the said vibrating curved surfaces with recesses to form what is herein termed "the upper griping edges," to act upon the pods near to the seeds towards the end of the operation. And, in combination with the vibrating curved surfaces, the employment of rollers, or their equivalents, acting intermittently."

151. For an *Improvement in Ploughs;* Thomas F. Chapin, Walpole, N. Hampshire.

Claim.—"I claim, 1st, Attaching the beam to the mould board by a pivot, for the purpose of allowing the outer end of said beam to be raised or depressed, as desired, and thereby give the share a greater tendency to enter the earth, and causing the furrows to be of the desired depth. 2d, The means for operating the beam, viz: the box or socket having within it a rack and pinion, the rack being connected to the beam by a rod."

152. For an *Improvement in Bottles;* William Clark, City of New York.

Claim.—"I claim forming bottles with an eye at the top or upper part of the neck, said eye having a passage through it at right angles, or not varying much therefrom, with the opening or passage of the bottle, for the purpose of receiving the cork and preventing the cork from being expelled from the bottle by the force of the gases generated by the fermentation or effervescence of the liquid within it."

153. For an *Improved Arrangement of Spring and Spring Catch for Closing Doors;* John Clark, North Hadley, Mass.

Claim.—"I claim the arrangement of the several parts, (on the casing and on the door,) when the whole is constructed to produce the result, in the manner described."

154. For a *Lubricating Compound;* George A. Colehamer, Reading, Penna.

Claim.—"I claim the combination of 9-16ths of a gallon of raw linseed oil, 7-16ths of a gallon of rosin oil, and 12 pennyweights of gum camphor, for a lubricator."

155. For *Omnibus Step Protector;* Thomas Coles, City of New York.

Claim.—"I claim, 1st, Constructing an appliance or covering for the steps of the omnibus, (made of wood, sheet iron, copper, or other material,) corresponding in width with the door, and the sides falling over the ends of the steps, secured to and moving with the door; and, 2d, Forming metallic triangular plates to be well secured to spring, bar, or otherwise shielding the ends of the hind spring."

156. For an *Improvement in Cultivators;* Charles H. Dana, West Lebanon, N. H.

Claim.—"I claim constructing each of the two outermost teeth with a horizontal

blade, projecting more or less outwardly from its shank, and with an upright portion bent up at the extremity of said outwardly projecting blade, the edge of said upright portion being parallel, or thereabout, with the longitudinal direction of the cultivator, for the purpose of cutting up the weeds close to the rows of corn or other plants, and at the same time drawing the weeds away from the rows, and also serving to guide the attendant in directing the cultivator so as not to injure the plants by too near an approach to them."

157. For an *Improvement in Striking part of Steeple Clocks;* G. Deuble, Canton, O.

Claim.—"I claim attaching to the beam or lever, which is operated by a pin on the wheel, and is provided with a detent for arresting the fly, the knee or its equivalent, to act in conjunction with the pins in the count wheel, as an inclined plane to raise the lever, till its detents take effect, and to escape from the pins when the lever is still further raised by the pin on the wheel."

158. For an *Improvement in Finishing Dies in Machinery for making Rings from Sheet Metal;* Charles W. Dickinson, Newark, N. J.

Claim.—"I claim forming the lower finishing die in two parts, of which the part (s′) is capable of being raised to effect the finished ring or link."

159. For an *Improved Arrangement for Lathe Chuck;* L. A. Cole, Salem, Ohio.

Claim.—"I claim the manner of combining and arranging the scroll screw, holding jaws, screw or mandrel, cutter, adjustable nut, gauge plate, sliding catches, and notched and grooved barrel, or their equivalents, for the purpose of constituting a machine which is capable of boring the hub entirely through in a true and perfect manner, and also of being adjusted and set so as to cut a shoulder of the required depth, and to enter the proper distance, and then of being adjusted as the operation is proceeded with, so as to square up the shoulder in a perfect manner."

160. For an *Improved Mode of Driving and Straining Saws;* James Fishwick and John Fishwick, Lexington, Kentucky.

Claim.—"We claim driving and straining the saw by two steam cylinders and pistons of unequal size, the larger being of sufficient size to drive the saw during its downward or cutting movement, and only receiving steam during such movement, and the smaller, which always contains steam, being of sufficient size to keep the saw strained while cutting, and to raise it and the larger piston."

161. For an *Improvement in Reading Tables;* Chas. Folsom, Cambridge, Mass.

Claim.—"I claim a combination of the tables with the levers."

162. For a *Mowing Machine;* Alanson Gale, Poughkeepsie, New York.

Claim.—"I claim the wheel, when so constructed and combined with the frame of a mowing machine as to support the cutter bar clear of the ground when pushed back, and lower it to its place when drawn forward."

163. For *Improved Machinery for Crushing and Pulverizing Ores, &c.;* Samuel Gardiner, Jr., City of New York.

Claim.—"I claim the employment of one or more stampers, having such a jumping motion as to leave them for some time in contact with the quartz or ore after every descent, and such a rotary motion that while they remain in contact with it between one descent and their next ascent, their rotary action will be sufficient to pulverize to a proper degree, that which was prepared by the breaking or crushing action of their descent."

164. For an *Improvement in Vehicles;* Abram J. Gibson, Clinton, Massachusetts.

Claim.—"I claim giving to the forward axle a bent form, in combination with arch springs, connected and bearing from axle to axle."

165. For an *Improvement in Butter Workers;* Ezekiel Gore, Bennington, Vt.

Claim.—"I claim a machine provided with an endless revolving sack, and having its parts arranged and operating for working, cleansing, and seasoning butter."

166. For an *Improvement in Grates;* Geo. W. Griswold, Carbondale, Pa.

Claim.—"I claim the hinging of the shakers in front of the grate, so as to give the ends thereof next the back the greatest extent of motion, and this in combination with the stops, which prevent the shakers from rising above the bottom of the grate."

167. For an *Improved Mill Stone Dress;* Edmund P. Gaines, Melrose, Texas.

Claim.—"I claim the manner of laying off the dress of mill stones with four curved master furrows, (by which I gain a draft equal to one-fourth the circumference,) in connexion with secondary furrows laid according to the directions given, for the purpose of more effectually grinding grain, increasing the quantity ground with a given power, producing a better yield of superfine flour, and avoiding both the choking and undue heating of the stones."

168. For an *Improved Water Wheel;* Benajah T. Hall, Seneca Falls, New York.

Claim.—"I claim the combination of the beveled or inclined curb with the central discharge water wheel; and, also, the eccentric discharging orifice, or its equivalent."

169. For an *Improvement in Bank Locks;* Augustus C. Harig and David C. Stoy, Louisville, Kentucky.

Claim.—"We claim the self-adjusting guard, arranged and operating the "usher," c, in such a manner that the introduction of powder or picking instruments into the lock through the key hole, is effectually prevented. Also, the arrangement and combination of the cam, which operates the belt, the dog, and the eccentric notch in the "usher," c, in such a manner that while the key, or any instrument substituted therefor, may be operating upon the tumblers, the said cam shall be intercepted by the dog, so that it cannot be brought into contact with the bolt, till said key or instrument shall have moved the tumblers as far as it is capable, for the purpose of preventing the act of "feeling" the positions of the tumblers, while the key or substituted instrument may be moving them."

170. For an *Improvement in Windows;* Mark A. Heath, Providence, Rhode Island.

Claim.—"I claim inserting in either side of the sash, a flexible expanding strip, formed in lengths, jointed or otherwise pliantly secured together, so that the sash is made to slide smoothly in the frame, the several lengths of the strip expanding and contracting to accommodate themselves to inequalities in the grooves in which they slide, for the purpose of forming a close joint between the sash and the frame."

171. For an *Improvement in Shirt Collars;* Walter Hunt, City of New York.

Claim.—"I do not claim making collars of paper; neither do I claim the peculiar fabric which I make use of; nor the enamelling and polishing such fabric; nor do I claim making paper or cloth water proof by means of varnish; but what I do claim is, the above described shirt collar, made of the fabric set forth, and polished and varnished in the manner and for the purpose specified."

172. For an *Improved Steam Boiler;* H. Jackson, of the Township of Elizabeth, Ohio.

Claim.—"I claim ,1st, The arrangement of the vertical water tubes and spiral flues in relation to the furnace, as described. 2d, The arrangement of the vertical water tubes surrounded by the non-conducting material, and the upper and lower horizontal tubes, in connexion with the heating surfaces, for the purpose of returning the water from the upper to the lower tube."

173. For an *Improved Device for Securing Ends of Wires in Fence Posts;* Wm. G. Lavers, City of New York.

Claim.—"I claim the method of securing the horizontal wires to the posts by having slots made in the posts, in pairs, and the ends of the wires passed through the lower slots of the several pairs, and bent in the form of hooks, the lower ends of the hooks passing through the lower slots of the several pairs, and placed either obliquely or vertically."

174. For an *Improvement in Cultivators;* Griffith Lichtenthaler, Limestoneville, Pa.

Claim.—"I claim the method of attaching the shares to the beams, viz: having metal strips, perforated with holes, secured to the undersides of the beams, and sockets formed of two lips made at the upper ends of the shares, and perforated with holes, in which holes, and in the holes in the plate, wooden pins are passed, securing the shares to the beams."

175. For an *Improvement in Eyelet Machines;* Hymen L. Lipman, Philadelphia, Pa.

Claim.—"I claim the so forming of the die and counter die, or follower and anvil block, of an eyelet machine, by concave grooves, channels, or their equivalents, as that the eyelets may be raised or clinched on both sides by a single operation, and without turning them over."

176. For an *Improved Coupling for Carriages;* Norman B. Livingston, Portland, Ind.

Claim.—"I claim coupling the front axle to the reach, and also the whiffle-trees of a wagon or carriage to the tongue, by means of the circular collar or eye-piece and grooved sectional circle plate."

177. For an *Improvement in Ditching Ploughs;* John Lyon, Harrisburgh, Iowa.

Claim.—"I claim the arrangement of the several parts, for the purpose of constituting a machine which is capable of cutting any depth of furrow, and of taking up the loose dirt or soil out of said furrow or ditch, as fast as it is formed, and convey and discharge it at right angles to the furrow or ditch, in a continuous stream, for the purpose of forming roads and foundations for fences, and for other purposes."

178. For an *Improved Mode of Securing Staples to Walls;* Jordon L. Mott, Mott Haven, New York.

Claim.—"I claim forming the anchor of a block cast on to the shank of a wrought iron staple or eye, and provided with a thin wing having flanches or ribs all cast and forming one substance with the block, whereby the cast iron part shall hold the shank firmly, and at the same time become an integral part of the mason work, and be firmly held therein by the superincumbent weight."

179. For a *Portable Soda Water Fountain;* James R. Nichols, Haverhill, Mass.

Claim.—"I claim, 1st, The peculiar arrangement of reservoir, generator, and purifier, compactly combined, as described. 2d, The arrangement for gradually throwing down the powdered chalk or soda, from the superior cylinder, and for closing up the same by drawing up the rod connected with the thumb screw."

180. For a *Mode of Stopping Mineral Water Bottles;* A. Quantin, Philadelphia, Pa.

Claim.—"I claim the compound stopper composed of the metallic core, the cork zone, and the india rubber spring."

181. For an *Improvement in Stove Regulators;* Washburn Race, Assignor to Horace C. Silsby and Washburn Race, Seneca Falls, New York.

Claim.—"I claim adjusting the stove regulator by attaching the nut and screw used for that purpose, at the top end of the same, and at the top of the stove."

182. For an *Improvement in Butter Workers;* Elihu Ring, Macklenburgh, N. Y.

Claim.—"I claim arranging the block to traverse, in combination with the spring, or its equivalent, to force it forward in the operation of working butter."

183. For an *Improvement in Platform Scales;* Elnathan Sampson, Windsor, Vt.

Claim.—"I claim the combination of the short longitudinally vibrating levers with the laterally vibrating longitudinal lever, by which I am enabled to construct scales of the largest size without using trussed levers. Also, the combination of the platform with the beam actuating double lever, or its equivalent, through the medium of the longitudinally vibrating levers and the laterally vibrating lever. Also, inserting a double concave intermediate block within the opening of each stirrup, between the sharp edge of the cross of the stirrup and the edge of the lever pivot, at right angles therewith, for the purpose of enabling the platform to swing freely in a lateral and longitudinal direction. without injury to said sharp bearing edges."

184. For an *Improvement in Sheet Metal Candlesticks;* J. W. Smith, Poultney, Vt.

Claim.—"I claim forming the base of a sheet metal candlestick of two sheets of different metals, which are of such proportions, respectively, that the upper is too thin to support the candlestick by itself, and has the requisite stiffness and strength imparted to its central portion, by fitting and firmly uniting thereto the under sheet."

185. For an *Improvement in Corn Cob Cutter;* Isaac Straub, Cincinnati, Ohio.

Claim.—"I claim the combination of a rotating burr provided with a blade or cutting edge on top, and with a toothed or roughened surface on its perimeter, and a stationary shell, also provided with a cutting edge, operating together sheer fashion, for slicing off and reducing ears of corn, preparatory to their undergoing a farther reducing or grinding operation."

186. For an *Improved Ditching Spade;* David Stouder, New Burlington, Indiana.

Claim.—"I claim the combination of the obtuse angled bottom cutter with the side cutters sloping upwards, the light steel ribs, the foot treads on the single or divided handle, and the claw hook for deep trenching."

187. For an *Improvement in Horse Shoes;* Wm. H. Towers, Philadelphia, Penna.

Claim.—"I claim the combination of the steel or other elastic springs having corks formed on their flexible ends, and capable of being removed and attached with facility and despatch, with the main body of the shoe."

188. For an *Improved Arrangement of Indicating Tubes for Ascertaining Draft of, and for Trimming Vessels;* John E. Vansant, Louisville, Kentucky.

Claim.—"I claim the arrangement of tubes and indicators, in the bow, stern, and quarters or wings, of light draft vessels, for the purpose of keeping her trimmed by indicating the true draft of water throughout her length and breadth, and preventing the hogging or straining of the hull."

189. For an *Improvement in Paddle Wheels;* Abraham Van Antwerp, Albany, N. Y.

Claim.—"I claim the construction and use, upon steamboat paddle wheels, of disconnected floats of a cima-recta and cima-reversa form, as shown, the same being placed upon arms set obliquely upon the shaft, and being so formed and placed that the end of the float enters and leaves the water on a line parallel with the direction of the vessel, whereby the beating down of the water by the float when entering, and the raising up of water when leaving, as in the ordinary transverse paddle, is prevented."

190. For an *Improvement in Seed Planters;* Charles A. Wakefield, Plainfield, Mass.

Claim.—"I claim so arranging and operating the plunger, in connexion with the receiving tube or chamber, and its delivery slide, or the equivalent thereof, that the plunger ejecting the corn deposited in the receiving chamber, is made to imbed the corn, from the surface of the earth to its required depth, obliquely into the ground, while the receiving tube or chamber, resting by a front stop plate on or above the ground, is made to open and close clear of all surrounding dirt, and the sides of the said chamber made to act as scrapers above the recesses to clear the plunger of adhering soil, and cover the seed therewith, throughout the entire withdrawal of the plunger, whereby the receiving tube or chamber is prevented clogging with dirt at its opening sides, the width of the opening made in the earth for the reception of the seed is diminished, and the corn covered with more certainty. Also, the method of operating the planter by the hand, at the side, in such a manner that the same force or pressure applied to working the plunger up and down, gives to the planter, automatically as it were, one and the same obliquity of stroke, in a backwardly direction downwards, or in a forwardly direction upwards, throughout its several operations, both on entering and leaving the ground, by means of the obliquely set handle on the rear side of the plunger, or other equivalent arrangement of the handle, producing the same action, and whereby the planter may be used with greater facility and expedition, and the recess formed for the planting of the corn be made with certainty of the necessary obliquity, without involving any delay in adjusting the direction or movement of the plunger to insure the earth, on the overhanging side of the said recess, falling in to cover the corn."

191. For an *Improvement in Polishing Wheels;* Benj. Webb, Unadilla Forks, N. Y.

Claim.—"I claim the forming of an elastic polishing wheel for polishing and grinding by the use of a series of springs placed under sections of the surface, moving vertically from the centre, and independent of each other."

192. For an *Improved Mode of Fitting Heads in Boxes;* C. Williams, Fallsburgh, Va.

Claim.—"I claim the angular form of three pieces of heading, which allows these being put in securely and often removed, without drawing a nail or moving a hoop."

193. For an *Improvement in Portable Bedsteads;* S. Willard, Cincinnati, Ohio.

Claim.—"I claim a bedstead, constructed of sheet metal side and end pieces, which are bent at their ends so as to form sockets for the reception of the sustaining and uniting posts, and provided with inward flanches at their lower edges for the reception of the hinged bottom plate, which serves at the same time to support the bed, and to keep the bedstead firm and in proper shape."

194. For an *Improvement in Apparatus for Cooking and Warming;* Daniel Willis, City of New York.

Claim.—"I claim the arrangement, construction, and united operation of the several devices forming the cooking and warming apparatus herein shown."

195. For an *Improvement in Hedge Trimmer;* Leonard Woods, Quincy, Illinois.

Claim.—"I claim, 1st, The arrangement of the cutters affixed on the face of a wheel on an inclined shaft, revolving so as to cut upwards as the carriage is advanced parallel to the sides of the hedge. 2d, The gauge, in combination with the horizontally revolving knives, both being adjustable to the required height for topping the hedge. 3d, Lifting the lower branches of the hedge to bring them within the range of action of the revolving cutters, by means of the bent bar, or its equivalent, thereby obviating the necessity of having the cutter wheel of large diameter, and allowing the cutters to be carried so high as to be free from all danger of striking the ground."

196. For an *Improvement in Cider Mills;* Daniel Ziegler, Lewistown, Penna.

Claim.—"I claim the arrangement of the spur teeth on the rollers in rows round the periphery of regular sizes in each row, but the teeth in the one row being larger than the teeth in the adjoining row, and the smaller teeth of the lower roller being arranged opposite the larger teeth of the upper rollers, and all three rollers running at different velocities."

197. For an *Improvement in Thimbles for Stove Pipes;* Daniel Wilson Assignor to Wm. F. Pratt, G. W. Bosworth, and H. M. Bird, Milford, New Hampshire.

Claim.—"I claim the combination of the rings, the thimble, the sliding plates, and the cover, with the ventilators."

198. For an *Improved Mortising Machine;* Birdsill Holly, Assignor to Silsby, Race & Holly, Seneca Falls, New York.

Claim.—"I claim the mode of working the chisel, consisting of the re-entering belt, or its equivalent, in combination with the spring and hand or foot straps, and in combination therewith, I claim the tongue strap, with its spring, for the purpose of keeping the belt loose upon the driving shaft. Also, the mode of reversing the chisel, or of keeping it in and out of gear, consisting in the combination of the hinged bar, the spring, the notched ring, the treadle, or its equivalent, and the rod connected with the gear wheel on the pulley frame."

199. For an *Improved Arrangement of Means for Working and Stopping Chain Cables;* T. Brown, London, England; patented in England, April 20, 1847.

Claim.—"I claim the arrangement of the capstan, the removable rollers, and the sockets for said rollers, in such a manner and having such relations to the hawse holes, chain locker deck pipes, and under-lifting stoppers, that a chain cable can be continuously hove in by means of said capstan and rollers, or be directly run out of the lockers, without any previous overhauling. Also, the arrangement of the under-lifting bow stoppers and after stoppers, by which more cable can be gradually and controllably given to a vessel, whilst riding heavily at anchor."

Additional Improvement.

1. For *Improvements in Looms for Weaving Figured Fabrics;* Saml. Eccles and Jas. Eccles, Philadelphia, Pennsylvania; dated July 18, 1854; original patent dated August 3, 1852.

Claim.—"We intend to apply the stop motion herein described, to looms having other kinds of shuttle box motions attached, and shall vary the form of the parts to suit the necessities of the various cases. We claim the mechanism which connects and disconnects the shuttle box motion to and from the cam shaft, that is, the bell crank lever, when kept in connexion with the grooved hoop or collar, by a spring, or its equivalent, in combination with the lever and its connecting rod, or any mechanical equivalent therefor, when the said lever is operated upon by a filling thread stop motion, when the filling thread breaks or becomes expended. Also, the pattern chain composed of lags, having projections or segment flanches on the top, and blank lags having no projections

on the top, for the purpose of operating rise and fall shuttle boxes therewith in power-looms for weaving figured fabrics."

Re-issues for July, 1854.

1. For an *Improvement in Machines for Pegging Boots and Shoes;* J. J. Greenough, City of New York; patent dated Jan. 17, 1854; re-issue dated July 4, 1854.

Claim.—"I claim the cutting of the peg from the peg blank, by a lateral motion of the cutter against the side of the blank, the cutter assisting to hold the blank in position while it is driven. Also, the combination of parts composing the "universal movement carriage," consisting of a disk supported upon the arm of a horizontal lever, so that it can be raised or lowered, surmounted by the device for holding the work, having a free motion in all directions. Also, the centre guide for directing the movement of the shoe or other article in the course indicated by the pattern of the sole, for the purpose of keeping the line of the pattern incident with that of the awl and peg driver. Also, so constructing, arranging, and operating the shoe carriage that each point of the sole which is to receive a peg shall be brought successively to the same point under the stationary pegging standard, so that the pegging shall be effected without interruption entirely around the shoe or other article. Also, in combination with the movable carriage, the stationary pegging standard made adjustable, or the equivalent of that adjustment, so that the pegs can be driven at any distance from the edge of the sole or centre of motion of the carriage holding the material to be pegged, so that a new pattern will not be required to drive a second row of pegs within the first row. Also, driving the pegs by a tool having a positive motion in both directions."

2. For an *Improvement in Gun Locks;* James Hultz, Berlin Township, Ohio; patent dated May 16, 1854; re-issue dated July 4, 1854.

Claim.—"I claim giving such a shape to the tumbler, or to the sear, or their equivalents, that the sear will not catch and safely hold back the cock in a cocked position, except when it is acted upon by a perfectly rigid force. And, in connexion with the said peculiar arrangement of the tumbler and the sear, I also claim the combination of the jointed levers with the sear, in such a manner that said levers will rigidly act upon the sear, and cause it to safely hold the cock when it is thrown into a cocked position. Also, the set screw, arranged in such a manner in relation to the jointed levers, the sear, and the tumbler, that its adjustment to a greater or less extent will render it necessary to exert a greater or less degree of power upon the trigger to detach the sear from its hold upon the tumbler, when the cock is in a cocked position."

3. For an *Improved Journal Box for Saw Mill Carriages;* Charles Fox, Chicago, Ill.; patent dated May 9, 1854; re-issue dated July 18, 1854.

Claim.—"I claim the combination of the notched plate, pawl, rack, pinion, lever, and sectional pawl, arranged as set forth. Also, the construction of the boxes with the opposite inclined inner faces, for giving the requisite set-off to the carriage when gigging back, and again setting up when moving forward for the cut."

4. For an *Improvement in Seed Planters;* Charles Randall, Palmyra, Georgia; patent dated November 2, 1852; re-issue dated July 25, 1854.

Claim.—"I claim the revolving cylindrical hopper, composed of two hollow buckets or disks, arranged a suitable distance apart, to form a central discharge passage in a horizontal revolving shaft, for the purpose of holding and agitating the seed and discharging it in the centre of the furrow in a straight line."

Designs for July, 1854.

1. For a *Tea or Coffee Pot;* William Hattersley and Charles Dickinson, Newark, N. J.; dated July 4, 1854.

Claim.—"The design of the ornamental work."

2. For *Cooking Stove;* John C. Smith, Assignor to C. W. Warnick and F. Liebrandt, Philadelphia, Pennsylvania; dated July 11, 1854.

Claim.—"The several ornaments in bas-relief and mouldings, forming the design of stove 'Great Republic.'"

3. For a *Radiator Stove;* S. H. Sailor and John C. Smith, Assignors to C. W. Warnick and F. Liebrandt, Philadelphia, Pennsylvania; dated July 11, 1854.

Claim.—"The ornaments in bas-relief on the body, foot, and urn, of the stove 'Lady Washington Radiator.'"

4. For a *Cooking Stove;* Harrison Eaton, Assignor to James Hartshorne and Winslow Ames, Nashua, New Hampshire; dated July 11, 1854.

Claim.—"The ornamental design for the side plate and its feet, and that of each door."

5. For *Well Curbs;* William Douglass and Benjamin Douglass, Middletown, Conn.; dated July 11, 1854.

Claim.—"The design displayed by a combination of the form and ornaments."

AUGUST 1.

1. For an *Improvement in Machinery for Making Matches;* Elkan Adler, City of N. Y.

Claim.—"I claim the perforated dipping board, moved and combined with the sliding frame. The combination of the springs, levers, shafts, pawls, rods, and button. The knives, in combination with the connecting piece, crank and lever. The grooved rollers, in combination with drum, grooved tables, and knives. And, the combination of the driving wheel, roller wheels, intermediate wheel and drum wheel, as set forth."

2. For a *Lubricating Material;* Wm. Little, of the Strand, County of Middlesex, England; patented in England, July 14, 1853.

Claim.—"I claim the combination of the "coal oil," or heavier oily product resulting from the second distillation of bituminous coal, (or a matter that will so produce a like oil,) with a saponified vegetable, animal, or fish oil or fat, and whether the coal oil be combined with the vegetable, animal, or fish oil or fat, after or during the saponifying process of the said composition, being intended as a lubricator for machinery."

3. For *Improved Bits for Carving Machines;* Charles F. Bauersfield, Cincinnati, O.

Claim.—"I claim the formation of an excavating bit, having its longitudinal contour corresponding to the designed vertical section of the relievo, and grooved along its sides and across its lower end or face, at or near the plane of its axis."

4. For an *Improvement in Brick Presses;* Collins B. Baker, Troy, N. York.

Claim.—"I do not claim constructing a sector shaped follower with a rectilinear nor a single curved concave pressing surface; but what I do claim is, constructing it with a pressing surface of two circular or curved concaves, which are proportioned to the increase of the distance from the centre of motion of the quadrant."

5. For an *Improvement in Steam Boiler Tubes;* R. C. Bristol, China, Michigan.

Claim.—"I claim the cutting, impressing, or otherwise increasing one of the surfaces of tubes or sheets of metal, which said surface is to form the radiating side of boilers, flues, or vessels, for the purpose of imparting heat to any liquid, vapor, gas, or to atmospheric air, when said cutting or impressing is of such a character as to admit of being made after the plates are bent up into form."

6. For an *Improvement in Stone Saws;* George W. Cherry, City of New York.

Claim.—"I claim, 1st, Constructing saws or blades for sawing or cutting stone, with inclined side grooves extending entirely across the body of the saw or blade. 2d, The use of fine grooves, depressions, or holes, made in the saws or blades between the sand passages. 3d, Constructing saws or blades alternately of hard and soft metal in the direction of their length."

7. For an *Improvement in Drying Thick Paper;* Ephraim and John R. Cushman, Amherst, Massachusetts.

Claim.—"We claim our process of drying thick paper, and at the same time preventing it from warping out of shape, to wit: by placing the sheets, in a pulpy state, upon heated tables or platforms, and allowing them to remain until they harden to such a degree as to begin to warp out of shape, and then causing open or lattice weights to be let down upon them, which rest upon their edges or points at different parts of the sheets, and preserve them in flat positions until entirely dry."

8. For an *Improvement in Door Locks;* William Cayce, Franklin, Tennessee.

Claim.—"I claim the arrangement of the levers and pawls with the bolt, the levers being guarded by the tubular key hole projecting inwards over them, and the pawls protected by the broad bolt beneath them."

9. For an *Improved Machine for Uniting Plates of Metal of Unequal Thickness;* J. Carhart, City of New York.

Claim.—"I claim, 1st, Making the punch and die of such relative sizes that the punch shall be incapable of entering the die at all, or of entering it with the same degree of freedom as would be necessary in an ordinary punching operation. 2d, Making the punch holder with a concave recess in its face, or otherwise furnishing the back of the punch with a shouldered face, which shall bear upon the face of the piece of metal which is entered by the punch, only in a ring at a distance from the punch. 3d, The employment of an upset plate, placed, after the punching operation, between the die and that portion of one plate or piece of metal which is protruded through the other, so that by repeating the movement of the punch, the said protruding portion may be upset or riveted. This I claim, irrespective of any mechanism that may be employed to carry the upset plate to and from the die."

10. For an *Improvement in Hot Air Furnaces;* John Carton and Joseph Briggs, Utica, New York.

Claim.—"We claim the inverted eone or deflector, when placed at the top of the chamber of hot air furnaces, constructed in the manner set forth."

11. For an *Improvement in Magneto-Electric Machines;* Ari Davis, City of N. York.

Claim.—"I claim the insulation of the journal of the shaft, in combination with the single conducting spring in magneto-electric machines."

12. For *Improvements in Drafting and Modeling Vessels;* Henry C. Deputy, Michigan City, Indiana.

Claim.—"I claim the application of diagonals to drafting and modelling all kinds of vessels propelled by sails, steam, or otherwise. Also, the principle by which the exact concavity of concave water lines is determined, viz: by transferring the intersections of the water lines (in the body plan) with each frame to a half breadth plan."

13. For *Improved Machine for Sawing Fire Wood;* John J. Efferenn, Springfield, Ill.

Claim.—"I claim the combination of a saw and saw horse with fly wheels, as described, through the agency of a lever, arm, and crank."

14. For an *Improvement in Machines for Moulding Crackers;* Phineas Emmons, City of New York.

Claim.—"I claim the use of the roller, made with cutters in its channel, in combination with the feed rollers, for forming and cutting dough into suitable shapes for making crackers. I also claim as new, for rolling dough into ball, the conical or nearly disk form of the wheels, whereby they are made, by their oblique position on their axes, to combine a twisting and rolling motion, the rolling motion only having been heretofore employed in cylindrical grooved rollers."

15. For an *Improvement in Revolving Breech Fire Arms;* Josiah Ells, Pittsburgh, Pa.

Claim.—"I claim, 1st, The use of a stud in the trigger, vibrating laterally, in combination with a level edged hammer, with a notch at its toe, by means of which, by simply pulling the trigger, the hammer is raised, and may be either allowed to stand at full cock, or fired at pleasure, while the trigger, after firing, will regain its position for repeated action. 2d, The use of a double spring, or spring and lever, for the purpose set forth. 3d, The mode of locking the rotating breech at the moment of firing, by means of the locking bolt, in combination with the cam shoulder on the trigger, and the hexagonal neck of the rotating breech, which nevertheless permit the breech to be fully rotated, by hand or otherwise, when the trigger is not drawn back."

16. For an *Improvement in Compasses and Callipers;* John E. Earle, Leicester, Mass.

Claim.—"I claim the combination of the hinged arms, screw rod and nut, with the hinged legs of compasses or dividers and callipers, for the purpose of moving or holding said legs in both directions, any where within the line of their sweep."

17. For an *Improved Pen;* W. R. Glover, Glasgow, Kentucky.

Claim—"I claim attaching lips to the pen, for the purpose of preventing the ink from ascending in the pen, and coming in contact with the fingers."

18. For an *Improvement in Brick Presses;* Isaac Gregg, Pittsburgh, Penna.

Claim.—"I claim giving a quivering or shaking motion to the combined brick discharger and mould duster, by means of the elastic pin which projects therefrom, acting upon the serrated edge, or by any other equivalent means, for the purpose set forth. Also, the cutters or pulverizers, when arranged and operating in combination with the pressure roller, for the purpose of breaking up and pulverizing the hard crusts of clay produced by said roller, and for properly working and supplying clay to the moulds."

19. For an *Improvement in Lathing Buildings;* B. F. Gold, New Haven, Conn.

Claim.—"I claim, 1st, The mode of making spaces between lath by turning spacing pins which are attached to slides, the mode of turning being by arms. 2d, Stationary spacing pins to make equal spaces between breaks of lath, and as a permanent footing against which lath are spread to touch the gauges. The spacing pins are on the rear of the frame. 3d, The gauges which are placed in front of any required number of lath, and are requisite to control the width of breaks, the spaces between lath, and to keep them level."

20. For an *Improvement in Mode of Attaching Thills and Poles to Vehicles;* Abram J. Gibson, Clinton, Massachusetts.

Claim.—"I claim the manner of attaching thills or poles to vehicles, by means of a steel spring, or its equivalent."

21. For an *Improved Mode of Attaching Whiffle-trees to Vehicles;* Abram J. Gibson, Clinton, Massachusetts.

Claim.—"I claim the manner of attaching the whiffle-tree to vehicles, by means of a steel spring, in the manner as set forth."

22. For an *Improvement in Wash Boards;* Joseph Hyde, City of New York.

Claim.—"I claim, 1st, The employment of the elastic or semi-elastic 'knuckles,' each distinct, but the whole forming a compact series over the whole rubbing surface of a wash board, of any usual or convenient form. 2d, I claim, in combination therewith, the rubber connected to it, so as to reverse to either side of the 'board,' and 'swiveling,' if desired, in its own immediate bearings."

23. For an *Improvement in Shot Pouches;* John M. Hathaway, City of New York.

Claim.—"I claim the devices for securing the top or chargers to the pouch, viz: the lugs, slots, and thumb catch, operating as set forth. Also, the method of gauging the charges by means of the inner and outer tubes or barrels, moving one within the other, and the slides working therein, and adjustable by means of the hollow thumb lever rod and nut."

24. For an *Improvement in Railroad Car Couplings;* D. A. Hopkins, Elmira, N. Y.

Claim.—"I claim having the draw head formed with a wide or flaring mouth and narrow neck, and using, in connexion therewith, a block, the front surface of which is of circular concave form, with recesses across it, whereby the links may be held in a horizontal or in inclined positions."

25. For *Improvements in Submerged Paddle Wheels;* W. F. Ketchum, Buffalo, N. Y.

Claim.—"I claim the arrangement of the centrifugal wheel relatively to the charge and discharge openings of the casing and the division of the interior of the said casing by the partitions, and so as to form the openings, so that the wheel shall take in water at its centre, and discharge it out of said openings on each or both sides of the stern post."

26. For an *Improved Mortising Machine;* William Henry Morrison and M. W. E. Doran, Indianapolis, Indiana.

Claim.—"We claim the combination of the alternately rising and falling chisels with the auger, so that both are in operation at the same time, as set forth, or by any known equivalent mechanical means; also, the combination of a number of such sets of chisels and augers, as described, for cutting mortises of greater or less length, as may be desired."

27. For an *Improvement in Houses for Switch Tenders;* Willis Mansfield, New Haven, Connecticut.

Claim.—"I claim the connexion between the switch house door, or its equivalent, and the switch or the actuating mechanism thereof, when said mechanism is arranged in the manner described."

28. For *Improvements in Stone and Marble Saws;* William Watson, City of N. Y.

Claim.—"I claim making saw plates for cutting stone, with channels at the sides, substantially for the supply of sand to the lower edge. Also, the excavations or notches on the lower edge, to contain and permit the sand more effectually to get under the edge of the saw plate."

29. For *Improvements in Feed Water Apparatus to Steam Boilers;* Benjamin F. Bee, Harwich, Massachusetts.

Claim.—"I do not claim, of themselves, in the boiler feeders, a water chest and slide valve, operating in connexion with a water supply vessel, and arranged so as to be self-regulating in keeping up a proper level of water in the boiler; nor yet do I claim causing the steam from the boiler to act, by pipes conveying it thereto, upon the surface of the water in the supply vessel to facilitate the discharge of water therefrom to the boiler. But I do claim the arrangement of the double slide valve water chest, and steam and water passages, with the water supply vessel, when the said supply vessel is made a compressed air receptacle by the immersion of the supply pipe below the top surface of the water therein, or the compression of the air in the supply vessel being otherwise equivalently produced, and so that a strong atmospheric pressure is brought to bear upon the surface of the water, to serve, conjointly with the steam passing from the water chest through pipe into the compressed air receptacle, to establish that necessary equilibrium of pressure above and below the water in the supply vessel, to produce a flow, and whereby the effect, by condensation or cooling of the steam entering the supply vessel, is neutralized, and a more immediate and certain discharge of water into the chest insured. And I further claim the method of varying the height at which the water will be sustained, by raising and lowering the chest and its attachments."

30. For *Improvements in Machines for Sticking Card Teeth;* G. W. Coats and J. Russell, Springfield, Massachusetts.

Claim.—"We claim the mode of imparting the intermittent motion to the main carriage for spacing the teeth, and reversing the same by means of the screw leader attached to the main carriage, and passing through a nut mounted in suitable boxes and rotated by cog gearing, when this is combined with a clutch operated by a cam, to clutch and unclutch the wheel, which receives motion from the wheel or wheels on the main shaft, and imparts the required and measured intermittent motion to the nut. Also, in combination with the mode described, of imparting the spacing motion to the main carriage, the employment of the cams on the main carriage, which, at the end of each transverse motion, act on a lever connected and combined with and operating the clutch to clutch and unclutch the wheel which receives motion from the main shaft, to operate the shifting wheel which operates the double clutch on the main shaft. Also, in combination with the mode described, of operating the main carriage, the mode of operating the second carriage which holds the sheet of leather to determine the space between the rows of teeth, by means of the shifting cam called the twill cam, and the shifting sector cog wheel, which in turn imparts motion by the cog wheels and shaft to the cog wheel through which passes the feathered shaft mounted on the main carriage, and which in turn imparts the required motion to the drums for lifting the second carriage at the end of each complete motion of the main carriage; and, in combination with this, we also claim making the nut on the screw leader in two parts, divided by a plane at right angles to the axis, when the two parts are attached together so that they can be turned on each other, substantially as described, so that the threads can be set to any wear of the threads, and thus avoid end play, as described. We also claim making the arbors of the two rollers with cylindrical bosses to determine their distance apart, in combination with the mode of mounting them between boxes and without interposed boxes, the said arbors being prevented from having end play by means of V shaped or curved fillets on the arbors, fitted to corresponding cavities in the boxes. We also claim mounting the bending fingers in the sliding top plate, independent of and below the slide or carrier of the former, around which the teeth are bent, the said carriage being provided with an inclined plane or cam, acted upon by a like inclined plane or cam on the top plate of

the fingers, so that as the fingers are drawn back, the former shall be lifted up preparatory to its back motion."

31. For an *Improvement in Mechanism for Measuring Cloth on Looms;* Halvor Halvorson, Assignor to H. Halvorson and Horace Barnes, Boston, Massachusetts.

Claim.—"I claim the combination of the following mechanical elements, or their equivalents, when operated by a stud from the lay, and by means of the cloth, as specified, the said combination being as follows: 1st, The lancet or cutter for puncturing the cloth. 2d, Mechanism applied to the lay and the cutter, for moving said cutter towards and into the cloth, and afterwards instantly out of the cloth, such mechanism being the slide, the ratchet, the bar, (with its tooth,) and the spring. 3d, Mechanism for moving the slide bar into and out of the path of the stud of the lay, as specified, such mechanism being the bar, the notched wheel, the gear wheel, the single toothed pinion, the worm gear, the screw, and the wheel, as applied or connected together, and operating substantially as described. I also claim arranging the lance or cutter on the breast beam, and close to the edge of it, where the cloth is bent downwards, the cloth roller, and when such lance or cutter has mechanism applied to it, and operated by the cloth and the lay, so as to put the said lance or cutter into operation, as specified; such arrangement of the lance or cutter on the breast beam, and in close proximity to its rear upper corner, enabling the lance or cutter to pass freely through the cloth, without danger of the latter being sprung away from it by the force of the blow and resistance of the cloth, as will occur when the lance is situated below the breast beam, and become worn or dulled."

32. For an *Improvement in Warping and Dressing Yarns;* Samuel T. Thomas and Eliza Ann Everett, Administratrix of Edward Everett, dec'd., Lawrence, Mass.

Claim.—"What is claimed is, 1st, Warping and dressing yarns directly from small spools or bobbins, instead of large section beams heretofore used, to sectional loom beams, for the purpose of securing a uniform tension in the yarns wound upon the loom beam, and also affording greater facilities for readily producing a variety in the stripe of the fabric. 2d, The fan cylinder for drying the yarns, composed of slats arranged with spaces between them, and around which slats the yarns are made to pass, revolving fans being arranged within the said cylinder, and revolving independently of and at a much more rapid rate than said slotted cylinders, whereby a large portion of the yarns are kept in a gentle current of air, and rapidly dried."

33. For an *Improvement in Fastening Lanterns;* Charles Monnin and William M Booth, Buffalo, New York.

Claim.—"We claim the application to lanterns of the cylindrical or hollow ring, inclosing one or more metallic clamps or dogs, which move horizontally through apertures into a groove."

34. For an *Improvement in Car Wheels with Independent Flanch and Tread;* Wm. S. McLean, Pittsburgh, Pennsylvania.

Claim.—"I do not claim the separate and independent flanch and tread, as that has been patented or described by James Jones, William Howard, and others; but what I do claim is, the wheel with the flanch and tread capable of separate action, when they are made to interlock and naturally support each other, so as to prevent any strain tending to separate them from being thrown entirely upon the journal."

35. For a *Threshing Machine;* William M. Palmer, Palmyra, Maine.

Claim.—"I claim the combination of the screens with the chutes, for screening and separating the grain, as set forth."

36. For an *Improvement in Moulds for Cement or Earthen Tube;* Bradford S. Pierce and Charles M. Pierce, New Bedford, Massachusetts.

Claim.—"I claim the combination of a core and spring case, substantially as set forth."

37. For an *Improved Dumping Car;* Alexander H. Petsch, Charleston, S. Carolina.

Claim.—"I claim the construction of railways laterally across the carriage, or otherwise, by which means I am enabled to dump the boxes by their own gravity, when let go from the apex of the plane, without labor to the operator. Also, the projection of the railway beyond and outside of the car carriage, by which means I am enabled to dump the boxes at such an angle as to discharge their contents, whatever may be the character of the load."

38. For a *Self-Loading and Dumping Cart;* Sanford Stone, Kirkersville, Ohio.

Claim.—"I claim, 1st, Arranging the cart body with a scraper on its fore end, and so as to tilt forward to the ground, for the purpose of scraping up the earth and loading itself immediately from the ground by its own action. Also, the employment of an endless horizontal belt for and in the place of the bottom of the cart body, so arranged and operated by any suitable means that it will be made to revolve in the proper direction during the time of loading and unloading the cart, but will not act while drawing the cart from place to place, for the purpose of assisting the operations of loading and dumping. Also, the combined arrangement of the cart body with the fulcrum or centre on which it tilts, (at a suitable distance from the revolving axle of the cart,) the driving cog wheels on said axle, and two pinions placed upon the shafts, by which the endless belt is driven, in such a manner that the forward pinion will play into said cog wheel when the cart body is tilted forward for loading, and the hind pinion play therein when the cart is tilted backward for dumping, but when in a horizontal position, neither pinion will be geared therewith, for the purpose of operating the endless belt when and only when required. Also, the combination and arrangement of the rack on the cart body, the pinion on the draft frame playing therein, the ratchet wheel on the pinion shaft, and the two clicks on opposite sides of the ratchet wheel, in such a manner that the cart body may be tilted to any position, and immovably held there."

39. For a *Method of Cleaning and Feeding in Grain to the Mill Stones;* Simon Shearman, Goshen, Indiana.

Claim.—"I claim the method of cleaning and feeding in the grain to the mill stones, by passing it through a cleaning apparatus, which is placed in between the hopper and stones, and driven by the stones."

40. For an *Improvement in Saw Mills;* John Stull, Philadelphia, Pennsylvania.

Claim.—"I claim, 1st, A swinging frame, or its equivalent, carrying a circular saw, so constructed and arranged that the saw may be made or allowed to cut its full depth in crooked as well as straight logs. 2d, The revolving self-acting wedge, hung or arranged so as to vibrate and accommodate itself to any crooks, curves, or inequalities in the log or stuff sawed. 3d, The floats or scrapers hinged to the carriage, or their equivalents, to push the saw dust in such direction as may be desired. 4th, I am aware that guides have been used to steady circular saws where they passed out of the log after cutting the score, and also where they enter a score already cut by the saw; therefore, I make no claims to guides used under such circumstances; but I believe guides have never been used prior to my invention, to steady and support circular saws, where they enter and cut the log as they enter. I therefore claim a circular saw, in combination with guides, so arranged as to steady and support the saw where it enters and cuts a score in the log, to prevent the saw from being swerved by knots, cross-grained, or hard places in the wood sawed."

41. For an *Improvement in Shoe Horns;* Lewis Schwingrouber, City of N. York.

"The nature of my invention consists in the use of a spring clasp, in combination with the shoe slip, by means of which the back of the shoe is securely held while being put on to the foot, and the metallic slip guides the heel down into place, the same as an ordinary shoe horn or slip."

Claim.—"I claim the spring clamp with its concave holding jaw, in combination with the shoe slip."

42. For *Improved Tires for Carriage Wheels;* George Souther, South Boston, Mass.

Claim.—"I claim the employment of tires of india rubber, or equivalent elastic material, inserted between projecting flanches, and projecting beyond said flanches, in the manner set forth. Also, using for said elastic tires an entire ring, to be stretched over and sprung between the flanches, in the manner set forth."

43. For an *Improvement in Fire Arms;* Eli Whitney, Whitneyville, Connecticut.

Claim.—"I claim the method of constructing the shear and lock bolt in one piece, combined with the method of operating the same by the trigger and spring, so that the sear cannot release the hammer, except when the chambered breech will be firmly locked in its proper position. 2d, Also, the combination of the trigger with the spring and the lock bolt, (when the lock bolt is of the same piece as the sear,) for locking the chambered breech and discharging the pistol. 3d, Also, the combination of the three springs (when

they are all secured with one screw,) with the catch lever, trigger, and the lock bolt and sear."

44. For an *Improvement in Cleaning Top Cards of Carding Machines;* H. Woodman, Biddeford, Maine.

Claim.—"I claim the combining of lifter cams and a brush bar with one rotary shaft, so that by the movement of such shaft, in the manner specified, the operations of raising and depressing a top card and cleansing it may be effected."

45. For an *Improvement in Bedsteads;* Simon Willard, Cincinnati, Ohio.

Claim.—"I claim constructing the bedstead of sheet metal posts bent longitudinally at right angles, to which are secured transverse flanches, and of a sheet metal sustaining box or boxes, which is supported at its corners by said flanches, and secured in place by rods passing down through both the flanches and sustaining box."

46. For an *Improvement in Fire Engines;* Albin Warth, City of New York.

Claim.—"I claim the arrangement and combination of a horizontal pump with a series of pinions and cranks, as described, by means of the long double rack and spring, attached cross heads, and platforms."

47. For an *Improvement in the Manufacture of Brooms;* William B. Walker, Bennington, New Hampshire.

Claim.—"I claim the process of manufacturing brooms or brushes by compressing the material and forcing it into a chamber, while in a compressed state, and securing it there by means of the clip, or other device, whereby the same end is obtained. That the material may be compressed by other devices than as described above, I am conscious, from experiment; therefore, it is the principle, practically carried out, which I wish to secure by letters patent, as well as the device by which it is done. The spring-catch and tongs, mentioned in my caveat filed, I consider as unnecessary."

48. For an *Improvement in Harrows;* Wm. Anderson, Ulysses, New York.

Claim.—"I claim inserting a tooth in each hinge, so that no part of the ground escapes being pulverized, whereas, in other harrows with hinges, a large space in the centre of the harrow escapes."

49. For an *Improvement in Lasting Instruments;* Thomas Dougherty, Erie, Penna.

Claim.—"I claim so constructing the machine that when drawn up I have ample room for putting in the tacks or pegs, and having a heel which serves as a fulcrum, so that by pressing back the top of the machine I am able to raise the entire jaw clear of the sole, and prevent the jaws from ruffling up the inner sole."

50. For an *Improvement in Cultivators;* Charles K. Farr, Auburn, Mississippi.

Claim.—"I do not claim any of the parts of my implement which are found in the cotton scraper, patented by Wm. C. Finney, April 24th, 1849; but I do claim the hollow standards cast with the ground plate, for firmly uniting the beam to the implement by means of bolts passing through said standards."

51. For an *Improved Hydraulic Press;* Robert Grant, City of New York.

Claim.—"I claim the combination of a flexible water and air-tight bag or medium of vulcanized india rubber cloth with an outside wire vessel, or its equivalent, in such manner as that when water or steam shall be forced into the inside of the bag, the bag or medium shall be thereby pressed outward, and any material contained between the same and the extraneous wire cylinder, shall thus be wrung or squeezed nearly dry by being pressed against the interstitial holes."

52. For *Improvement in Ploughs;* John S. Hall, Manchester, Pennsylvania.

Claim.—"I do not claim the mere hinge joint of the mould board, formed of similar sized stubs, as that is the subject of a patent granted to me, 7th February, 1854; but what I claim is, the dissimilar sized hinges, as described, causing the wings of the mould board to raise in proportion to their expansion, in connexion with the curved hinged braces sustaining said wings at their expansion, and admitting of extreme contraction,

without destroying the requisite form of the mould board under all its changes, (a requisite hitherto not attained,) for the purpose of adapting the plough to a variety of work or uses. I also claim the effectual securing of an iron beam to an iron standard, by means of the inclined segmental slot and bolt or nut, or their equavalent, operating in the manner described."

53. For an *Improvement in Horse Power Hoisting Machinery;* Abraham Jackson, City of New York.

Claim.—"I claim the arrangement of the shafts with their hoisting drums so combined by shifting clutches and gearing that the various operations for the hoisting and lowering of goods into or from ships, warehouses, &c., may be effected by a horse, or other power acting continually in one direction."

54. For an *Improvement in Machines for Cleaning and Drying Grain;* Horatio N. Black, Philadelphia, Pennsylvania.

Claim.—"I claim the employment of the inclined perforated cylinder for drying grain by the action of centrifugal force, in combination with the above described apparatus for cleaning the grain."

55. For an *Improvement in Screens for Hulling Clover Seed and Cleaning Grain;* M. H. Mansfield, Ashland, Ohio.

Claim.—"I claim constructing a screen for cleaning clover seed and the various kinds of grain, in several sections jointed together, when made independently adjustable at each joint, for the purpose of facilitating or retarding the passage of the straw, chaff, and other impurities over it, according to their nature or condition."

56. For an *Improvement in Cultivators;* D. W. Shares, Hamden, Connecticut.

Claim.—"I do not claim, of themselves, the expanding and contracting wings, as such have before been used in corn ploughs and cotton scrapers; but I do claim providing the expanding and contracting hoeing wings on either side with cultivator teeth projecting downwards on the inside of the hoeing wings or scrapers."

57. For an *Improvement in the Cap or Withe for the Masts of Vessels;* Jas. W. Sikes, Plymouth, North Carolina.

Claim.—"I claim the constructing of a withe with a main bar and shackles, so that one withe will serve all the purpose of the two heretofore used, and so that all its wearing or chafing parts may be removed and replaced by others, without disturbing it on the mast, as set forth."

58. For an *Improvement in Felt Hats;* John W. Whittal and William W. Pendleton, Greenwich, Connecticut.

Claim.—"We claim the formation of hats from felt cloth in sheets, combined with gutta percha also in sheets, said materials, after being united, to be formed into shape by pressure in a mould or upon a block, while the gutta percha is in a plastic state."

59. For an *Improvement in Machines for Planing Metals;* Dustin F. Mellen, Wentworth, New Hampshire, Assignor to self, and to John F. Augustus, Somerville, and Samuel A. Eaton, Boston, Massachusetts.

Claim.—"I claim the circular table, constructed and operated as set forth, the rotary motion of the table being dependent upon the longitudinal motion of the carriage."

60. For an *Improvement in Seed Planters;* Wm. Bullock, Assignor to Barton G. Morss, Red Falls, New York.

Claim.—"I claim, 1st, The seeding wheels, formed so that the seeds pass in at or near the centre of the wheels, and out at the periphery. 2d, The arrangement of one and the same wheel for sowing in drills and planting in hills. 3d, The arrangement of the tubes. 4th, The guards in combination with the seeding wheels. And, 5th, The marker for the purpose of indicating the position of each hill, thereby enabling the operator to plant in hills, forming rows both ways across the field."

MECHANICS, PHYSICS, AND CHEMISTRY.

On the Results of a series of Experiments on the Decomposition of Water by the Galvanic Battery, with a view to obtain a constant and brilliant Lime Light. By the Rev. N. J. CALLAN, Prof. of Nat. Philos. in the Rom. Cath. Coll. Maynooth.*

Continued from p. 209.

To determine the smallest number of cells of the cast iron battery which are as effective as any larger number in decomposing water, I measured the quantity of the mixed gases produced in two minutes by 3, 4, 5, 6 and 12 cells, and also the deflexion of the needle produced by the current from each battery when it passed through a solution of carbonate of soda in which there was about an ounce and a half of soda to each quart of water.† From the steadiness of the needle, it was evident that the current from each battery was perfectly constant during the two minutes it was allowed to act. The quantity of the gases produced by 3 cells was less than three-fourths of the quantity produced by 4, and less than half the quantity produced by 6.

Hence 3 cells are not as effective as 4, 5 or 6. The quantity of the gases produced by 3 cells was sensibly less in proportion to the sine of the angle of deviation shown by the sine galvanometer, than it was when 4 or 5 cells were employed. Hence it appears, that, for want of sufficient intensity, a sensible portion of the electric current produced by 3 cast iron cells passes through a solution of carbonate of soda without producing decomposition; and therefore in decomposing water, 3 cells cannot be used with advantage. On one occasion the current was sent from 3, 4 and 6 cells, through a solution of sulphate of soda mixed with some carbonate of soda. The quantity of mixed gases was very nearly in proportion to the number of cells and to the sines of the angle of deviation shown by the sine galvanometer. The sine of deviation appeared to be a little less, in proportion to the quantity of the gases produced, with 4 than with 3 or 6 cells. In this case, the sulphate of soda as well as the water was decomposed; for when the flame of the gases was thrown on lime, the bright white light produced by the oxhydrogen flame was surrounded by another dim light of a purple hue. With the solution of carbonate of soda alone, the quantity of the gases produced by 4, 5, or 6 cells appeared proportional to the number of cells and to the sines of deviation. Hence, cast iron batteries of 4, 5, or 6 cells will be equally effective in producing decomposition. But a battery of 4 cells will work as long and a half with a given charge as one of 6 cells, and as long and a quarter as one of 5; because in these batteries the quantity of electricity constantly flowing through each cell is proportional to the number of cells. Hence in preparing a battery for decomposing water, all the cells should be arranged in rows of 4 each. Four cells produced more than half the

* From the Lond., Edin., and Dub. Philos. Mag., Feb., 1854.

† The quantities of the gases produced by 1 or 2 cells were so small, compared with that which was produced by 3 or 4, that I did not measure them.

quantity of the gases produced by 12 cells of the same size. A battery of 60 cells, arranged in one series, after having worked for some time, produced in one minute very little more than 4 cells of the same size. I have not yet tried the decomposing power of a battery of a larger number acting in one series; but I shall have occasion, in the month of February, to show to my class a battery of about 250 cells; and I will then measure the quantity of the gases produced in one minute when all act in one series. Eight cells, arranged in two rows of four each, so that the two end zinc plates were connected as one, and the two iron cells also acted as one, produced considerably more of the mixed gases in two minutes than was produced by 12 cells of the same size acting in one series. The quantities of the gases produced by the 8 and the 12 cells were in the ratio of $11\frac{1}{2}$ to 9. But with the 12 cells, the sine of deviation shown by the sine galvanometer appeared to be greater in proportion to the quantity of the gases produced than when the battery of 8 cells in two rows was employed. Hence it would appear, that when the intensity of the current is much greater than that of 4 or 6 cells of the cast iron battery, the ratio of the quantity of water decomposed to the quantity of electricity passing though it is diminished; and consequently that Mr. Faraday's law of definite electro-chemical decomposition does not hold for powerful currents, which differ much in their intensity. In my last experiments I perceived a defect in the magnetic needle employed, and therefore do not feel myself warranted in drawing a positive conclusion. Besides, I am sure that my experiments were not made with as much accuracy as Mr. Faraday's were; but they incline me to believe that the decomposing power of strong currents decreases when their intensity increases. I am inclined to believe that there is a certain intensity above and below which there is a loss of decomposing power; and that, in a cast iron battery, it is the intensity of 4 cells in one series. I am inclined to think that, when the intensity is greater than that, some of the electricity passes through water without meeting the resistance or re-action necessary for decomposition; and that the greater the intensity the greater the quantity which passes without the required resistance. The current from a battery of 12 cast iron cells does not meet with much resistance in passing through a solution of carbonate of soda. For when the current was sent, without passing through the fluid, through the coil of the tangent galvanometer, it produced a deflexion of 69°; and when sent first through the fluid and then through the coil, the needle was deflected to 68°. When a current was sent from 60 cells, first through the fluid and then through a pair of coke points, the deflexion was the same as when it passed through the coke points without passing through the fluid. Hence a current from a battery of 60 cells appears to meet with as little resistance in passing through a fluid as in passing through a wire. Hence a current of very high intensity experiences little or no resistance or re-action from the fluid, and therefore can produce little effect on it.

In comparing the deflexion of the needle produced by a current from 6 cells through a solution of carbonate of soda, with the deflexion produced by the current from the same battery sent directly through the coil of the galvanometer, it occurred to me that if 12 cells were arranged

in two rows, and the two end zinc plates connected as one, and the two iron cells connected so as to act as a single cell, the current from these two rows would, after passing through a fluid, produce a greater deflexion of the needle than they would, if, whilst they acted in one series, the current were sent directly through the coil of the galvanometer. Subsequent experiments proved that my conjecture was well founded. When 12 cells were arranged in two rows of six each, and the current from both was sent through a solution of carbonate of soda and then through the coil, a deflexion of 67° was produced in the needle of the tangent galvanometer. When the current was sent from the same 12 cells acting in one series through the coil alone, the deflexion was only 64°. Hence more electricity passed from the two rows of six each through the fluid, than from 12 cells through the wire. Now it is well known, that when a current of electricity passes from one end of a battery to the other through a conductor in which it meets no resistance, the same quantity will pass in a given time between the ends of the battery, whether it consist of a single pair, or of a hundred or of a thousand circles, or of any number whatever. Hence more electricity will pass in any time through a solution of carbonate of soda from 12 cells arranged in two rows of six each, than will pass in the same time through a wire or fluid from a thousand, or any number of cells of the same size. Therefore whether Mr. Faraday's law hold for powerful currents of great intensity, or whether the conclusion drawn from my experiments be just, 12 cells, arranged in two rows of six each, will produce more decompositon in a given time than will be produced by a thousand, or any number of cells acting in one series. I have found, in the same way, that 8 cells, in two rows of four each, will produce as much, or nearly as much, of the mixed gases in a given time as any number acting in one series. Hence, with the common voltameter, a battery of 500 cast iron cells, arranged in rows of four, will produce more than fifty times as much of the mixed gases as it will produce when all the cells are arranged in one series. Besides, when the cells are arranged in rows of four, the battery with a given charge will act about twice as long as when all act in one series; for in the latter case about twice as much electricity passes constantly through each cell as in the former, and consequently the power of the battery is exhausted about twice as soon. Hence, on the whole, with the common voltameter, a battery of 500 cast iron cells arranged in one series will not produce the hundredth part of its full decomposing effect; but with the voltameter I have described, it will, as I have shown, produce its full effect. If a battery of 4 cast iron cells, and another of 1000 or of any number of cells of the same size be similarly charged, the former will, before its power is exhausted, produce as much of the mixed gases as the latter; because the former will produce in each minute as [half much as?] the latter, and it will work twice as long.

I will here mention one of the experiments from which I inferred, that in a voltameter for a battery of a large number of cells arranged in one series, the number of decomposing cells should be about one-fourth of the number of cells in the battery. When the current was sent from 12 cells in series, through 4 decomposing cells and through the coil of the galvanometer, the deflexion was a little less than that which was pro-

duced by the current from 3 cells when it passed through one decomposing cell and the coil. The difference arose from the imperfect insulation of the cast iron cells. But when the current was sent from the same 12 cells through 4 decomposing cells, and then through the helix of an electro-magnet by which a small magnetic machine was driven, the speed of the machine was considerably greater than when the current from 3 cells passed through one decomposing cell, and then through the coil of the electro-magnet. The wire coiled on the electro-magnet was about 50 feet long and one-eighth of an inch thick. The coil of the galvanometer is about 7 feet long and three-eighths of an inch in diameter. The resistance in the latter was insensible compared with the resistance in the former.

The ratio which the acting surface of each electrode should bear to that of the zinc in each circle may be found by putting a pair of large plates into a glazed vessel, and connecting them with the opposite ends of a battery of 4 cast iron cells in each of which the zinc plate is small, so that the current will pass through the coil of the galvanometer. If a solution of carbonate of soda be then gradually poured into the glazed vessel until the needle ceases to recede from the magnetic meridian, that is, until no more electricity is transmitted through the fluid, it will be found that the acting surface of each of the electrodes, which is covered by the fluid, is about an once and a half as the acting surface of the zinc plate in each circle. By pouring the fluid to any height whatever into the glazed vessel so as to increase the acting surface of the electrodes, no increase will be produced in the deflexion of the needle. Hence there is a limit to the conducting power of fluids for electricity of low intensity. A solution of carbonate of soda (no matter how thick and short the column of fluid may be) will not, when interposed between the opposite ends of a nitric acid battery of 4 cells, conduct more than about one-half of the electricity which will be conducted by a short, thick wire connected with the opposite ends of the same battery. In investigating the ratio which the surface of the electrodes should bear to the surface of each zinc plate of the battery, I used solutions of carbonate of soda of different degrees of strength, and found that the conducting power of a solution, which contains an ounce in each quart of water, is very little inferior to that of the strongest solution, whilst it foams far less. If a neutral salt could be found, which, when mixed with carbonate of soda, would prevent its foaming, and would not be decomposed by the voltaic current, sheet-iron plates coated with an alloy of lead and tin would be in every way preferable to platina electrodes. I have tried nitrate of potash, bisulphate of potash, bichromate of potash, sulphate of soda, borate of soda, and chloride of sodium mixed with carbonate of soda. But they were all decomposed by the galvanic current, as was evident from the light which the gases produced. When the current was sent from the battery through a solution containing three ounces of bichromate of potash and five of carbonate of soda in about five quarts of water, there was scarcely any foam, but the light produced by the gases was tinged with red, and not so intense as the oxhydrogen light. The heat of the flame appeared not inferior to that of the oxhydrogen flame. When bisulphate of potash was mixed with carbonate of soda, the light

and heat produced were the same as when bichromate of potash was used. The light was injured much less by mixing bichromate of potash or bisulphate of potash with the carbonate of soda, than by the mixture of any of the other salts with it.

(To be Continued.)

For the Journal of the Franklin Institute.

On the Practicability of a Line of Telegraph across the Atlantic. By Wm. C. M'Rea, Telegraphic Engineer.

The subject of a telegraphic line to connect Europe and America, is one which at the present time, appears to engross the attention of many capitalists and business men, both here, and on the other side of the Atlantic. The fact of the telegraphic cable extended across the Channel, from Dover to Calais, connecting England with France, having worked for a considerable time with perfect success, and the fact that submarine lines from England to various other points on the Continent, have already been carried into successful operation, together with the assurance from a reliable source, of there being a path, as it were, through the ocean from the eastern coast of Newfoundland to the western coast of Ireland, where a telegraphic cable may be stretched and rest upon the bottom, without liability of being in any manner disturbed, places it beyond a doubt, in the minds of many, that the thing is fully expedient, so far as relates to the construction, laying down, and durability of the cable. The most important point, then, which remains to be decided, is, whether or not, the line will work after it is completed.

It is true that an *Air Line* of telegraph corresponding in length to the distance between the points proposed for connecting the Atlantic cable, has been worked, in this country, by the Morse Instrument, in a single circuit, at a time when the ground was frozen, and the air clear and dry; the most favorable circumstances as respects insulation. This, however, was not done with the whole of the galvanic power, located at the two extremities of the line, as must necessarily be, in the line in question, but with the batteries interspersed at distances of a hundred miles, or thereabouts, apart.

I am well aware that, in the opinions of some, this can make no difference, as it will be said that the necessity for having to thus augment the number of batteries along a line, arises from the imperfect insulation of the wires; but I have found by experience on a line of a few hundred miles in length, on the highlands in Mexico, where, for six months at a time, a drop of rain does not fall, and in consequence of which, defective insulation of the wire could not, at such a time, be supposed to exist to any extent, that the line worked better with small batteries of equal intensity, located at the several stations along the line, than with the same amount of battery material combined and located at one point. But let the effect of placing the batteries at the extremities of so long a line, be what it may, there still remains one difficulty, which in the use of a recording telegraph instrument, will not be easily overcome.

Professor Faraday, in some recent experiments made with the submarine and subterranean lines in Europe, found that on the wires of these

lines, the galvanic current is retarded in its action, by the effect of induced currents. By a calculation deduced from said experiments, it will require a little over two seconds of time, for the electric current to cross the Atlantic. It was also found that the lateral induced current, lingers by static force upon the wire, making its electrical action visible after the galvanic circuit is actually broken. Here is a difficulty, which, if not overcome, must render it impossible to work a recording instrument on a submarine or subterranean line of any great length of circuit, for if, on completing the circuit, the passage of the galvanic current be retarded, a blank must naturally appear where a letter or part of a letter is intended. And, again, if the current lingers so that its effect is perceptible after the galvanic circuit shall have been broken, the consequence must be, that when a stroke is made with the key, thereby closing the circuit a sufficient length of time to make a dot upon the paper, a line will appear instead, thus rendering it impossible to form dots, spaces, and lines, according to the will of the operator, as is now done upon the air lines.

Translated for the Journal of the Franklin Institute.

Preservation of Meat.

We translate from the *Annales de Chimie et de Physique*, the following article, taken originally from the *Annalen der Chemie und Pharmacie.* The experiments detailed are at least worth repeating, for if the conclusions of the author be true, the mode of preservation discovered will frequently be very valuable.—Ed.

" *On the filtration of air as a method of preserving organic substances from putrefaction.* By Wm. H. Schröder and Th: de Dusch.

"An organic substance recently boiled with water is preserved from putrefaction by a current of air properly filtered through cotton. This interesting fact has been demonstrated by the following experiments:

"Meat with water was placed in a glass globe closed air tight by a waxed cork, and traversed by two tubes bent at right angles: the first of these tubes reached inside of the globe to a short distance from the meat, and was in communication with a gas-holder filled with water, which served as an aspirator. The second tube was connected with a horizontal one 60 centimetres long, (about 23·5 inches,) 3 cm. (1·2 inches,) wide, and filled with cotton. The outer end of this tube was closed by a cork through which passed a small tube allowing the air to enter.

"A similar globe received the same quantity of meat and water which remained exposed to the open air.

"Things being thus arranged, the water in the two globes was boiled for some time so as to expel the air and coagulate entirely the juices of the meat; then the stop-cock of the aspirator was turned allowing the water to flow out drop by drop, and drawing the air slowly through the tube filled with cotton. The experiment was begun on the 9th of February, 1853, and was continued without interruption until 6th of March. During the second week, the meat and *bouillon* contained in the open globe, had entered into putrefaction, and exhaled an insupportable smell. The other globe was opened at the end of twenty-three days, and the contents found perfectly untainted. Not the slightest smell was noticed,

and when it was heated, the peculiar aroma of fresh and warm boiled meat was perceived.

"The experiment was repeated with the same success from the 20th of April, to the 14th of May; and from them we may draw the conclusion, that meat recently boiled, and the *bouillon*, are preserved without change in a current of air filtered through cotton. The same result is obtained by operating on the yeast from beer, a very fermentable substance as is known. Exposed for twenty-three days in a current of filtered air, the yeast lost neither its smell, nor its sweet taste, nor its slightly acid re-action.

"On the other hand, some experiments were tried under the same conditions for the preservation of boiled milk, and meat simply heated by a sand-bath without the addition of water. These experiments gave a negative result, inasmuch as the milk and the meat putrified as quickly in a current of filtered air, as in the open globes.

"A final experiment was made in the hotest season of the year with boiled meat and *bouillon;* and whether the boiling was not complete, or from other circumstances, these materials were not kept without alteration. This last experiment, however, cannot invalidate the positive results given by the former ones.

"The authors add, that certain spontaneous decompositions of organic substances appear to require for their commencement and completion, only the presence of atmospheric oxygen; such are the putrefaction of raw meat, of the caséine of milk, and the transformation of lactine into lactic acid. In other phenomena of fermentation and putrefaction, it is not only the oxygen which acts, but also certain unknown elements of the air which may be eliminated by heating it, as M. Schwann did, or by filtering it through cotton."

For the Journal of the Franklin Institute.

An Account of some Comparative Experiments made at the Washington, D. C., Navy Yard, April, 1854, *on the ordinary mode of setting Land Boilers, and on the mode patented by* Henry F. Baker. By B. F. Isherwood, Chief Eng., U. S. Navy.

(Continued from page 200.)

Third Experiment.

The third comparative experiment deserving attention, was made at East Boston, Massachusetts, by Messrs. Parrott & Nason, on a boiler set, first, in the "ordinary manner" as approved by Mr. Otis Tufts, a manufacturer of steam machinery, and then in the manner patented by Baker. This boiler was a plain cylinder, 30 feet 6 inches long. It was first set in the manner commonly used in mills in the vicinity, but no information is given as regards the calorimeter, either with the "ordinary" or with "Baker's Setting." In both cases the boiler was heated up several days before experimenting, to thoroughly dry the brick work and avoid any error resulting from the moisture contained in it. Each charge of coal was weighed from time to time, and as nearly as possible, half a charge (70 pounds) thrown in every half hour. The clinker, ashes, and unburnt coal were weighed as removed. The water was also weighed as often as the boiler was fed; it was weighed *previously* to being fed

into the boiler, where it was evaporated under the pressure of the atmosphere with open sefety valves: the quantity and times of filling with water, were made as regular as possible, for the purposes of comparison, and to avoid mistakes. At the termination of the experiment with the "Ordinary Setting," it was altered to the "Baker's Setting" and an experiment conducted with that, in all respects the same as with the previous one. The coal used was the Dauphin County, Pennsylvania, anthracite, in lumps averaging 0·223 pounds. The area of the grate surface was 7·901 square feet, the area of the heating surface way 118·000 square feet, the ratio being as 1·000 to 14·935: the openings between the grate bars were each, 0·0618 feet wide. The following are the data and results, viz.

	Ordinary Setting.	Baker's Patent Setting.
DATA.		
Duration of the experiment in hours and minutes, .	48·30	48·20
Total pounds of coal consumed, . .	3806	3736
" " wood consumed (for kindling,)	74	99
" " ashes, clinkers and unburnt coal made,	1160	1029
" " *fuel* consumed, estimating two pounds of wood equal to one pound of coal, . .	3843	3785½
Total pounds of *fuel* consumed, deducting clinkers, ashes and unburnt coal, ...	2683	2756½
Pounds of fuel consumed per hour, deducting clinkers, ashes and unburnt coal, . . .	55·32	57·03
Pounds of fuel consumed per hour, deducting clinkers, ashes and unburnt coal, per square foot of grate surface, .	7·002	7·218
Temperature in degrees Fahrenheit of the feed water,	56°·9	62°·2
Total pounds of water evaporated from temperature of the feed water, ...	20229	25509
Pounds of water evaporated per hour from temperature of the feed water, ...	417·09	527·77
Temperature in degrees Fahrenheit of the smoke chimney,	255°·2	379°·1
RESULTS.		
Pounds of water evaporated from temperature of feed water, by one pound of coal, after deducting clinkers, ashes and unburnt coal, ...	7·540	9·254
Pounds of water evaporated from temperature of 212° Fah. by one pound of coal, after deducting clinkers, ashes and unburnt coal, ...	8·791	10·737

From the above table it appears, that the evaporation with the "Baker's Setting" was 22·14 per centum economically greater than with the "Ordinary Setting," taking the evaporation with the latter as unity.

Supposing the composition of the anthracite used in this experiment to be the same as that of the anthracite used in the previous experiment, we shall have for the absolute total theoretic evaporation of this coal $(14{\cdot}624\times0{\cdot}9489=)$ 13·877 pounds of water from a temperature of 212° Fah. per pound of coal; and as the coal contained 5·11 per centum of oxygen and hydrogen, the evaporation of 10·737 pounds of water from a temperature of 212° Fah. by one pound of coal, will be increased to $\left(\frac{10{\cdot}737}{0{\cdot}9489}=\right)$ 11·315 pounds of water from a temperature of 212° Fah. by one pound of *carbon;* which allows a loss of 22·6 per centum for draft, radia-

tion, &c., from the total theoretic evaporation of 14·624 pounds of water from a temperature of 212° Fah. per pound of carbon.

It is evident from the temperatures of the smoke chimney and the evaporations, that the calorimeter with the "Ordinary Setting" must have been *very much greater* than with the "Baker's Setting," for this temperature with the former was 255·2° Fah., while with the latter it was 379·1° Fah., although 22·14 per centum more heat had been extracted from the coal with the latter than with the former. The difference in the temperatures of the smoke chimney can only be explained on the supposition that the calorimeter with the "Ordinary Setting," which gave the lowest temperature of chimney, was so much greater than with the "Baker's Setting," as to allow the heated gases to lose their temperature by a very considerable expansion, rendering a large portion of the heat latent; while the much smaller calorimeter used with the "Baker's Setting," preventing any loss from this cause, kept the sensible temperature much higher and of course effected with it a much greater evaporation. The standard calorimeter with the "Baker's Setting" appears to be from two to three inches between the bottom of the boiler and the last bridge wall; this space is only from one-fourth to one-third of what is used with the "Ordinary Setting," but there is no reason why as small a calorimeter should not be used with the one mode of setting as with the other; hence, so far as these experiments go, they only prove how greatly the evaporation is affected by proportion of calorimeter, and not the determination of any gain in virtue of the "Baker's Setting" *per se.* The temperatures of the smoke chimney in the above experiments are only correct relatively, they cannot be taken for the correct temperatures of the escaping gases; that temperature with such a boiler, every engineer knows would be at least double, but when the heated gases are delivered into a large chimney, larger than the calorimeter of the flue, open to the air, they immediately expand, and a large proportion of their heat becomes latent and insensible to the thermometer.

A comparative experiment was made by "Messrs. Jones & Homer, from the Departments of Engineering and Chemistry in the Scientific School of Harvard University," under the direction of E. N. Horsford, Rumford Professor in the same University, on boilers with the "Baker" and "Ordinary" mode of setting. These experiments are published by Mr. Amory *in extenso*, and they appear to have been carried on with a great attention to minute details; how accurately they were conducted and how qualified the experimenters were for such a task, plainly appears from the fact, that with the "Baker's Setting," an evaporation of 16·431 pounds of water was obtained from a temperature of 212° Fah. per pound of anthracite, the clinker and ashes having been previously deducted. Now, we have already seen, that the absolute total theoretic evaporation per pound of anthracite, the clinkers and ashes being first deducted, is only 13·877 pounds of water from a temperature of 212° Fah., which amount the report of the experimenters exceeds by 18·4 per centum, though it is practically impossible to come within that per centage of the theoretical evaporation under the most favorable type and proportions of boiler. Such experiments it is unnecessary to discuss.

All the foregoing experiments, from the very mode in which they were conducted, must contain a considerable error as regards the evapo-

rative results given. This error makes the evaporation appear to be considerably greater than what it really was, and arises from the manner of conducting it, the steam being blown off into the air through the usual safety valve and escape pipe: the inevitable result of this mode of getting rid of the steam is, that as it rushes out from the boiler through the escape pipe with great velocity, it *entrains* and carries out with it a large amount of solid water in a finely divided state or in the shape of spray; and as the feed-water is measured *before* it goes into the boiler, it is evident, that the more the water is thus foamed or carried out entrained by the steam current, the higher will the *apparent* evaporation be, though the less the real evaporation will be; because an amount of heat has been lost measurable by the difference between the temperatures of the feed-water and the steam, multiplied by the weight of water thus escaping. It is also evident, that the more rapid the generation of steam is, the greater will be the foaming with the same escape pipe; therefore, in a comparative trial thus conducted, the highest evaporator will appear higher proportionally than it really is. Every practical engineer of extended observation is aware of the truth of the foregoing, and that the amount of solid water carried out of the escape pipe of a boiler, with ordinary proportions, when the fires are brisk and all the steam generated is being blown off, averages from one-quarter to one-third of the amount of water fed in.

The experienced engineer knows, also, that with the type and proportions of the boilers used in the foregoing experiments, nothing like the evaporations stated can really be obtained, and that their amounts will suffer a very considerable reduction were the experiment correctly repeated. The only proper mode of conducting such experiments is by working off the steam through a cylinder, and taking, by an indicator, the pressure at the end of the stroke, then calculating the amount of water from the relative proportion between steam of that pressure and the water from which it was generated. This system, though not free from some slight objections, avoids more than any other, the many sources of errors incidental to such experimental inquiries.

It is owing to the mode adopted by experimenters on the comparative steam generating powers of different coals, of conducting the evaporation by blowing off the steam into the atmosphere through safety valves and escape pipes of ordinary proportions, which mode gives, as has already been stated, erroneous results, making the evaporation appear too high; that both the comparative and absolute evaporative results obtained from various coals as given by Professor Johnson in this country, and by Playfair and De la Beche in England, not only cannot be depended on, but are notoriously contradicted by the every day's experience of steam boilers on a large scale, and under the ordinary conditions of practice.

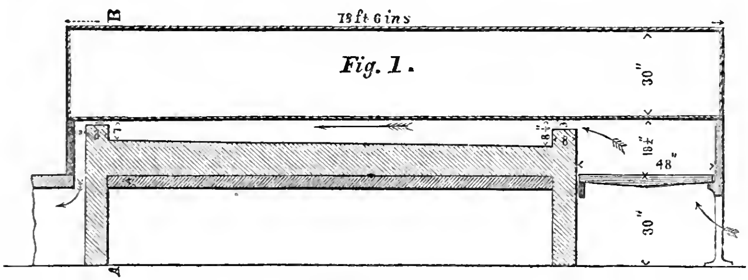
Comparative Experiments made by Engineer-in-Chief D. B. Martin, U. S. Navy, at the Washington, D. C., Navy Yard, April, 1854.

As a consequence of the very high results presented in the printed pamphlets of Mr. Amory, and stated to have been obtained from the careful experiments detailed therein, and which have been received above, the Navy Department was urged by him to adopt the "Baker Arches" generally for marine as well as for land boilers, Mr. Amory asserting, not only the superior excellence of such an arrangement, but its

equal applicability to all types and lengths of boiler. Still, as these experiments and statements were presented by an interested party, it was necessary before accepting or rejecting, to verify or disprove them by a *really comparative* experiment, made by a properly qualified government engineer of indisputable skill and integrity. Such an experiment was made at the Washington Navy Yard, under the immediate direction of the Engineer-in-Chief, D. B. Martin, and in the presence of Mr. Amory and a number of Naval Engineers. The results may be implicitly depended on as the truth, both as regards accuracy of observation, and skill in the conduct of the experiments.

The two pairs of boilers used in making these comparative experiments were precisely alike, such portions only of the brick setting being different as were required for the difference between the "Ordinary" and the "Baker" mode of setting. Both pairs of boilers belonged to the No. 2, stationary non-condensing engine of the Yard; one pair being a spre set for use, while the other might be being cleansed or repaired. Both pairs of boilers delivered their heated gases into the same chimney, which is about 20 inches square.

The pair of boilers having the "Ordinary Setting," is represented in Fig. 1. Each boiler is a plain cylinder, 18 feet 6 inches long and 30

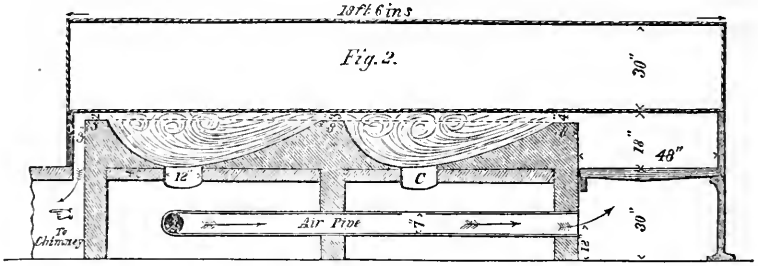


Ordinary Setting.

inches diameter, without flues; the distance in the clear between the boilers is 3 inches. There is a bridge wall at each end of the boiler, the height between the bottom of the boiler and the bridge wall at the furnace end is 3 inches, and the calorimeter, or area of opening, is 250 square inches; at the chimney end, this height is 1½-inch, and the area of opening 125 square inches. The atmospheric air for combustion is supplied beneath the grates through the ordinary ash-pit doors at this point, and the arrows indicate the direction of the draft.

The pair of boilers having the "Baker's Setting," is represented in Fig. 2. Here there are three brick bridges, one at each end of the boilers and one equidistant between them; the spaces between these bridges are arranged in an inverted parabolic curve, for the purpose of reverberating the heated gases, in the manner shown in the figure. The distance between the bottoms of the boilers and the bridge walls at the furnace end is 4 inches, at the chimney end 2 inches, and at the intermediate bridge 3 inches. The atmospheric air for combustion, is supplied beneath the grates through an iron pipe 7 inches diameter, with an elbow communicating with the external air; the ash-pit doors in front are tightly

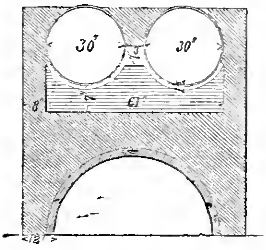
closed up. At the bottom of each parabolic curve, there is a circular opening (C. Fig. 2,) 12 inches diameter, for communicating with the lower closed chamber containing the iron pipes. The arrows indicate the direction of the draft.



Baker's Patent Setting.

In both pairs of boilers, there are exposed to the action of the heat 39 inches circumferentially of the bottom of each boiler, giving the total heating surface for each pair of boilers 117 square feet. The fire grates for each pair of boilers, are 4 feet long by 5 feet broad, giving an area of 20 square feet, or a ratio of grate to heating surface of 1·00 to 5·85.

With the boilers set as above described, the comparative experiments hereinafter detailed, were made. The "Baker mode of setting" was personally directed by Mr. Amory, and was made at the government expense, Mr. Amory being allowed to arrange it as he pleased, and it embraces all of what are termed *the latest improvements*; after it was finished, it was put in use with full coal fires for two days, which fully dried the brick work, and then the trial commenced with the temperature of the water in the boilers 180° Fahr. The weather throughout the trial with the "Baker's Setting" was fine, and favorable for high results.



The other pair of boilers were set in the "Ordinary" manner, by Engineer-in-Chief, D. B. Martin, in the manner approved by him, and shown in Fig. 1. For two days previously to commencing the trial, a small wood fire was kept on these boilers to warm up the water to the same temperature of 180° Fahr., but it was quite insufficient to dry the great mass of wet mortar and brick work. During the three days' trial with the "Ordinary Setting," the weather was fine on the first day, on the second day cloudy in the morning and rainy in the afternoon, and on the third day a very hard rain storm throughout.

The coal used in these experiments was the Pennsylvania Lackawana anthracite, carefully weighed, very uniform and free burning, giving about 1·33 per centum of clinker, and 8·79 per centum of ashes. The duration of each day's experiment was the same, and nearly the same amount of fuel was fed to the furnaces at the same intervals. Every precaution was taken to make the experiments *strictly comparative*, and as fair as possible.

The steam pressures in the boiler and in the valve chest were taken by the gauge; indicator diagrams were taken every hour, and the steam pressure in the cylinder at the end of the stroke was obtained from them. The calculations of the evaporation were made from the steam pressure in the cylinder at the end of the stroke, taking the number of charges of steam of that pressure furnished, considering a charge of steam to be the bulk comprised between the steam slide and the piston at the end of its stroke, and between the cut-off and steam slide valves reduced to the bulk which would be occupied by an equivalent pressure. This aggregate bulk was one and a half cubic foot, which was the quantity of steam used per single stroke of piston. In calculating the evaporation, two pounds of wood are taken to be equivalent to one pound of coal.

The diameter of the engine cylinder was $9\frac{1}{8}$ inches; the stroke of piston, 36 inches; space displacement of piston per stroke, 1·363 cubic foot; steam cut-off at in cylinder, 10 inches from commencement of stroke.

The following Tables, numbered 1 and 2, exhibit, respectively, the data and results, viz:—

TABLE 1.—*Containing the Data of the Comparative Experiments with the "Baker" and "Ordinary" modes of Setting Boilers, made at the Washington, D. C., Navy Yard, April,* 1854.

DATE.	Duration of the trials in hours and minutes.	Number of double strokes of piston made during each trial.	Steam pressure above the atmosphere in lbs. pr sq. in.			Fuel consumed.				Temp. of feed water in ° F.
			In boiler per gauge.	In valve chest per gauge.	In cylinder at end of stroke per indicator.	Total pounds of coal put into the furnaces.	Total lbs. of wood put in furnaces.	Lbs. of ashes, clinkers, and unburnt coal remaining.	Lbs. fuel consum'd, estimating 2 lbs. of wood = 1 lb. coal, and deducting the ashes, clinkers, and unburnt coal.	
				Baker's Setting.						
Ap. 10,	10 5	27174	55·70	48·05	5·73	803	440	230	793	138°
11,	10 0	26464	53·75	47·40	6·63	889	274	259	767	138°
12,	10 0	26000	54·16	48·20	6·48	867	274	244	760	138°
Totals,	30 5	79638				2559	988	733	2320	
Means,			54·34	47·76	6·37					138°
				Ordinary Setting.						
Ap. 13,	10 0	25304	54·03	48·50	6·78	837	440	$201\frac{1}{4}$	$885\frac{3}{4}$	138°
14,	10 0	26212	57·81	52·84	6·53	879	274	247	769	138°
15,	10 0	26746	53·68	49·41	5·97	$889\frac{1}{2}$	274	255	$771\frac{1}{2}$	138°
Totals,	30 0	78262				$2605\frac{1}{2}$	988	$703\frac{1}{4}$	$2396\frac{1}{4}$	
Means,			55·83	50·90	6·45					138°

TABLE 2, *Containing the Results of the Comparative Experiments with the Baker and Ordinary modes of Setting Boilers, made at the Washington, D. C., Navy Yard, April,* 1854.

DATE.	Absolute Evaporation.				Economical and comparative evap'n.			
	Cubic feet of steam evaporated during each trial.	Volume of steam compared with volume of water from which it is generated, the latter being unity.	Cubic feet of water evaporated from a temperature of 138° F., during each trial.	Pounds of water evaporated from a temperature of 138° F., during each trial.	Lbs. water evap'd from temp. 138°F by 1 lb. fuel, 2 lbs. wood=1lb. coal. Ashes, clinkers, and unburnt coal not deducted.	Lbs. water evap'd from temp. 138°F by 1 lb. fuel, 2 lbs. wood=1lb. coal. Ashes, clinkers, and unburnt coal being deducted.	Relative economical efficiency of the evaporation by the fuel. Ashes, clinkers, and unburnt coal not deducted.	Relative economical efficiency of the evaporation by the fuel. Ashes, clinkers, and unburnt coal being deducted.
				Baker's Setting.				
Ap. 10,	81522	1256·92	64·8585	4053·6563	3·9625	5·11180	1·05978	1·10623
11,	79392	1208·17	65·7126	4107·0375	4·0030	5·35468	1·07061	1·15880
12,	78000	1215·82	64·1542	4009·6375	3·9937	5·27584	1·06812	1·14173
Totals,	238914		195·6019	12225·1187				
Means,		1221·43			4·0043	5·26945	1·07095	1·14035
				Ordinary Setting.				
Ap. 13,	75912	1200·52	63·2326	3952·0375	3·7390	4·62092	1·00000	1·00000
14,	78636	1213·27	64·8133	4050·8313	3·9870	5·26766	1·06633	1·13996
15,	80238	1243·48	64·5270	4032·9375	3·9288	5·22740	1·05076	1·13125
Totals,	234786		192·8665	12054·1563				
Means,		1217·35			3·8891	5·03043	1·04014	1·08862

From the above tables it will be perceived that the "Baker's Setting" was 4·75 per centum economically better than the "Ordinary Setting," taking the latter as unity; but it is evident that when the more unfavorable state of the weather during the experiments with the "Ordinary Setting," and particularly the more moist condition of the brick work, are considered, as well as the trifling errors inseparable from all experimental inquiries, it is impossible to conclude other than that the two modes of setting are equally efficient, and consequently, no advantages are to be derived from the Baker arches.

The influence of the moist brick work is very sensibly shown by comparing the results of the first with the second days' trial, in the two cases. With the "Baker's Setting," the brick work being better dried at the commencement than with the "Ordinary Setting," the second day's trial gave 4·75 per centum better result than the first day's trial; while, with the "Ordinary Setting," the second day's trial gave 14·00 per centum better results than the first day's trial.

If the results from the first day's trial in both cases be omitted, and the

comparison be made for the last two days only, it will be seen that the two modes of setting gave very nearly the same results, being expressed by 1·15026 for the Baker, and by 1·13560 for the Ordinary; and this, in my opinion, is the proper comparison to be received.

The reader will not fail to observe the very great difference between the *absolute* evaporation obtained in these experiments, and in the experiments previously discussed, published by Mr. Amory. In the experiments of Mr. Martin, although the proportion between the heating and grate surface was more unfavorable to high evaporative results, than in the experiments offered by Mr. Amory, yet the combustion was exceeding slow, averaging only about 5·1 pounds of fuel per square foot of grate surface per hour, and the calorimeter small, and the coal excellent; hence, it will be seen that the results given in Mr. Amory's experiments cannot be the *true evaporation by the fuel*, but must express, in addition to that evaporation, the amount of water entrained by the steam current up the escape pipe, and thrown out of the boiler in the solid state.

In the Navy Yard experiments, an attempt was made to ascertain the temperature of the escaping gases of combustion as they passed over the last bridge wall, by means of a mercurial thermometer, graduated up to 540° Fahr., but the glass tube broke by the expansion of the mercury within, showing the temperature to have been far above the highest graduation limit.

For the Journal of the Franklin Institute.

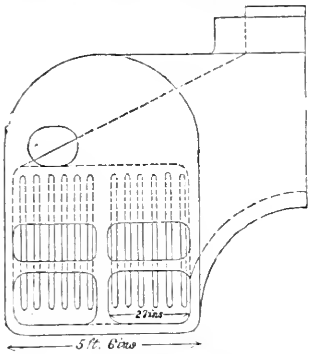
Notes on the Application of Lamb & Sumner's Boilers to the U. S. Steamer Vixen. By Wm. H. Shock, Chief Eng., U. S. N.

During the year 1851, the Bureau of Construction, Equipment and Repairs, were induced to adopt a plan of boiler (known as the Lamb & Sumner Patent) for several of our Naval Steamers, among which we mention the *Alleghany*, *Princeton*, *Massachusetts*, and *Vixen*. The general design of the boilers was the same in all, the only difference being that rendered necessary by the variation in size of hull, engines, &c.

The *Princeton*, after a serious delay of several months, was finally completed, (being the *first* of the number furnished with these boilers,) and left Baltimore for Norfolk, to join the Japan Squadron under Commodore Perry, which had also been detained by the *Princeton*, and was then about to sail, when her debut (viz. the trip to Norfolk) developed the mortifying fact that, the Lamb & Sumner boilers were *absolute* and *unequivocal* failures. She was *at once* abandoned for the Expedition, and her place subsequently supplied by another steamer (*Powhatan*).

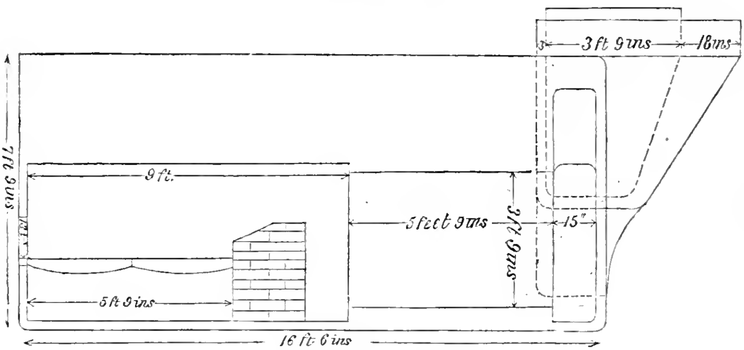
I here leave the *Princeton* for the present, in the hope that a future paper upon the boilers of this ship, which I propose to submit, may at *least* contain some facts of a practical nature that may prove useful as a warning voice (to those who are less able than our liberal Government) not to experiment upon boilers of this class, at least not until we are supplied with accurate drawings of those that are represented as producing such *remarkable* results abroad, with all the attending circumstances, such as sizes of ship, engines, consumption of fuel, &c., &c.

Immediately upon the receipt at the Navy Department of the results of the *Princeton's* debut, the proposed boilers for the *Massachusetts* were abandoned, as the work upon them had not yet been commenced. The work on those for the *Alleghany* also, was suspended, though they were partly finished, until a plan for alteration had been adopted; after which both those for the *Alleghany* and *Princeton* were altered by introducing horizontal tubes. Thus we find, that out of the *ten* boilers of Lamb & Sumner Patent, which were to *revolutionize* our Steam Navy and add so essentially to its efficiency; we have but *two* in existence to remind us of their early contemporaries, and these we find in the *Vixen*, a vessel of the following general dimensions:

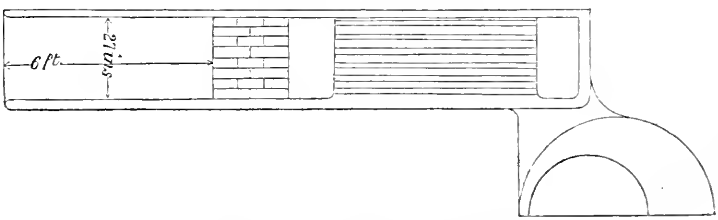


Front View.

Side Elevation.



Half Plan. (Inboard.)



Scale 3-16*ths of an inch, equal* 1 *foot.*

Length on deck,	118 feet.
Breadth of beam,	22 " 6 inches.
Depth of hold,	9 " 3 "
Tonnage,	234
Average draft of water,	7 "

Engines.—One horizontal half beam engine, (Lighthall's patent.)

Diameter of cylinder,	3 feet.
Length of stroke,	6 "
Diameter of paddle wheel,	18 " 6 inches.
Length of bucket,	6 " 3 "
Average dip,	3 "

Her boilers, two in number, are placed one on each side of the ship, with side connexions, as shown in the drawing. Their proportions are as follows:

Whole amount of fire surface,	. .	1450 square feet.
" " grate "	. .	56 " "
Height of chimney from grate bar,	. .	36 feet.
Diameter of " " "	.	38 inches.
Fuel, bituminous coal, natural draft.		
Ratio of fire surface to cubic foot of cylinder,	.	34 to 1
" " " grate surface,	.	25 to 1
" of grate surface,	. .	1·3 to 1

The following abstract was carefully taken from the *Vixen's* steam log during her late cruise in the Gulf of Mexico:

DATE.	Revs.	Steam.	Vac'm.	Throttle.	Cut-off.	Coal.	Saturation.
July 21, '53.	13 4	16·2	24	7 8-10	6-10	546·3	$1\frac{3}{4}$
" 22, "	14·4	16·2	24	$7\frac{1}{2}$	6-10	541·8	$1\frac{3}{4}$
" 23, "	14·8	16·4	$24\frac{1}{2}$	7	6-10	601·9	$1\frac{3}{4}$
" 24, "	14·6	17·2	25	7	6-10	559	$1\frac{3}{4}$
Mar. 4, '54.	12	14·3	28	$1\frac{1}{2}$		484·9	$1\frac{3}{4}$
" 5, "	13·6	12·9	$27\frac{1}{2}$	$1\frac{1}{2}$		470·3	$1\frac{3}{4}$
" 10, "	13·2	12·8	27	1		529	$1\frac{3}{4}$
" 12, "	13	10·8	$27\frac{1}{4}$	1		486	$1\frac{3}{4}$

Remarks.—From July 21 to 24, 1853, light head winds and seas.
" March 4 to 5, 1854, light head wind and smooth sea.
" March 5 to 12, fresh breeze on starboard quarter.

It will be observed, that there is no mention of the speed of the ship in the abstract given, but since my object is only to get at the *merits* of the boilers, that can be sufficiently attained from the particulars furnished. The loss of heat by "blowing" will be found to be about 12·2 per cent., hot well, 115°.

The accompanying drawing has been carefully prepared, in part from actual measurements, and may serve to convey a good general idea of this form of boiler, from which, with the abstract, a very correct estimate of the boilers may be obtained.

For the Journal of the Franklin Institute.

Trial Trip of the Steamship Quaker City. By J. Vaughan Merrick.

The Engineer's trial trip of this ship (for dimensions of which, and particulars of machinery, vide Vol. xxvii, p. 272,) took place on the 6th and 7th September, in the Delaware River and at sea. As the details of her performance are required to complete the account previously given, I shall proceed to state them.

The coal used was Lehigh, no Buck Mountain or other soft anthracite being procurable. The boilers being intended for natural draft, certain descriptions only of anthracite can be advantageously employed as are soft and free burning, giving a long flame. Of these, the kind known as "Buck Mountain" is the best, and will be employed on the regular trips,

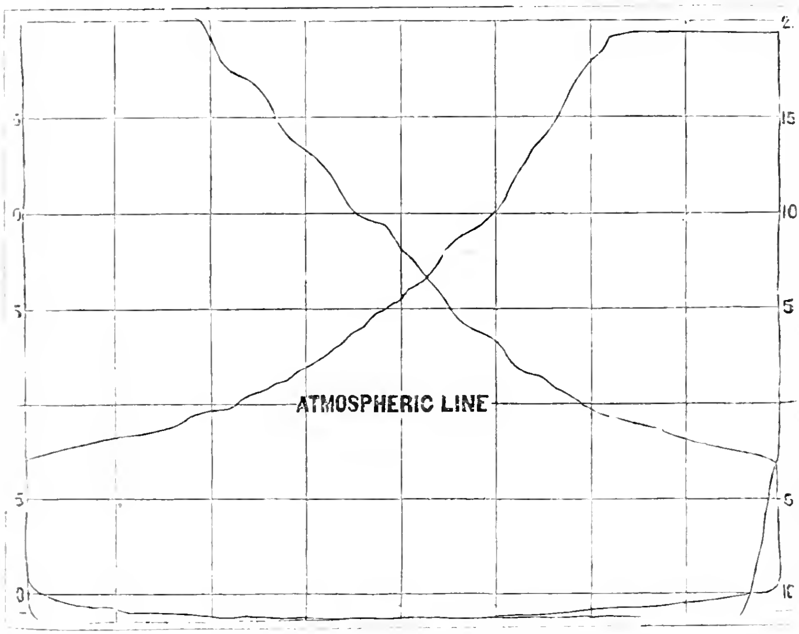
while the Lehigh, though well adapted to a forced blast, is unsuitable to boilers with natural draft. The speed of the ship, or steaming capabilities of the boilers, cannot, therefore, be judged of from their performance on the trial; so far as regarded the operation of the machinery, however, it was fully satisfactory. The *Quaker City* has a single side lever engine, with equilibrium poppet valves, and Allen & Wells' cut-off, and with Pirsson's fresh water condenser, constructed with certain modifications not before introduced, which will be hereafter described. There are four return tubular boilers, placed two forward and two abaft the engine, presenting a very large amount of heating surface, (in the aggregate, 7820 sq. ft.,) the object of which was to obtain an abundance of steam in dead calm weather, when the draft is deficient in intensity. The coal bunks occupy the whole length of engine and boiler space, and hold 270 tons, (instead of 180, as previously stated.)

The condenser is placed between the cylinder and air pump, is 7 ft. 10 inches high above the bed plate, 5 feet 8 inches wide athwartships, and 5 feet 4 inches long. The exhaust steam is conducted from the side pipe through a pipe leading around the side rod to the condenser, entering it rather above the middle of its height. The steam passes thence into a copper box bolted to the back tube sheet of the upper range of tubes. This box has a projecting nozzle slipping over a copper gland placed from the outside of the condenser and secured by the flanch of the exhaust pipe. The joint is therefore not perfect between the pipe and copper box. Between this latter and the tube sheet, is a plate perforated with $\frac{5}{8}$th holes opposite each tube, thereby compelling the steam to enter all the tubes simultaneously. Having traversed the upper range, the water and uncondensed vapor enter the "fresh water chamber," comprised between the front tube sheet and the end of the condenser; the vapor uncondensed, returns through the lower range of tubes, which ascend one inch to the lower box beneath the upper one. This box contains a partition extending its whole length and nearly to the top, outside of which the bottom is omitted; so that, while the condensed water returns through the tubes to its chamber, the vapor passes over and mingles with the injection water, becoming finally condensed. In the bottom of the "fresh water chamber" is an opening and pipe leading to two single-acting air pumps, 15 inches diameter and 20 inches stroke, worked from the side lever, which pump the fresh water into a tank overhead, whence it is drawn by four force pumps, each $4\frac{1}{4}$ by 48 inches, each separately provided with a fresh and a salt water feed valve, and each feeding its own boiler. In the upper range there are 1890, and in the lower, 530 tubes, all 1 inch outside diameter, 4 feet long, of copper, 20 ounces to the square foot. The front tube sheet is bolted over a gum joint to a flanch cast on the interior of the condenser; the back ones carry the copper boxes, which are free to slide on supports.

The injection water is introduced over the upper tubes by a large pipe into a strainer box, is thence distributed, and after falling between the tubes of the upper range, is shed off to the sides of the condenser by a shield over the lower or supplementary injection pipes; the latter (being governed by a separate valve,) give fresh cold water to the return or lower range of tubes, and insure a more perfect condensation.

The peculiarity of this condenser, therefore, consists in the return being made *below*, and under injection water not heated by contact with tubes of the upper range. By this arrangement, the condenser is made self-operative ; for, in case the fresh water air pumps fail to act, the water rises only above the lower range of tubes, fills them, and flows into the bed-plate through the equilibrium opening in the lower box, leaving the upper range of tubes always free to receive the exhaust steam.

No. 1. No. 2.



The operation of the condenser on the trial may be seen by inspection of the accompanying indicator diagram, (which is a fac simile of the original, and not in any way reduced or altered).

Conditions of the Ship on the Trial.

Draft forward, . . .	9 feet 9 inches.
" aft, . . .	11 " 6 "
" mean, . . .	10 " 7½ "
Amidship section immersed, . .	340·5 square feet.
Displacement at that draft, . .	1474 tons.
Coal on board, . . .	205 "
Dip of wheels at that draft, . .	5 feet 1 inch.
Diameter of wheels outside of buckets, .	31 "
" " inside " . .	27 " 9 inches.
Effective diameter (of centre of pressure) at that draft and dip,	29·56 feet.
Circumference at centre of pressure, . .	92·86 "

Performance.—During the upward run, the time of the ship's passing the following points, with all the particulars of performance of the engine

at the same time, were carefully noted, and are given in the following Tables:—

PLACES.	Passed at hours A. M.	Time between, in minutes.	Distance run in statute miles.		Revolutions.			
			By Coast Survey, (Total.)	Deducting for tide; betw'n points.	Total by Register.	Between points. (Register.)	Per minute.	Per mile.
Ledge Light Boat,	6 51				15228			
Delaware City,	9 13½	142½	36·50	31·74	17262	2034	14·13	64·10
Newcastle,	9 36	22½	42·50	5·24	17592	330	14·66	63·17
Marcus Hook,	10 30	54	56·50	12·20	18349	757	14·02	62·05
Navy Yard Shears,	11 49	79	77·00	17·87	19444	1095	13·88	61·30
Totals and means,		298		67·05		4216	14·15	62·87

The tide being favorable, deduction has been made for it, allowing its speed of current at 2 miles per hour, which has been obtained from repeated experiment.

The following Table gives the pressure, vacuum, &c.; it should be remarked that the vacuum given, from the attachment of the gauge, shows the vacuum on the piston:

Time of observation.	Steam in pounds per gauge.	Throttle.	Vacuum in inches per gauge.	Cut-off.	Revs. per min.
6 51 A.M.	20	Half op'n.	24¼	2 ft. 3 in.	13·60
7	21½	" "	24⅛	2 3	14·30
7 15	22½	Wide "	24¼	2 3	14·37
7 30	23½	" "	24½	2 3	14·45
8	23½	" "	23½	2 3	14·40
8 30	22½	" "	23½	2 3	14·30
9	20	" "	23½	2 3	14·30
9 30	20	" "	24	2 3	14·20
10	21½	" "	23¾	2 3	14·20
10 30	21½	" "	23¾	2 3	14·25
11	21	" "	23¾	2 3	14·05
11 30	20	" "	24	2 3	13·90
11 45	19½	" "	24	2 3	13·70
Means,	21·4	Wide.	23·8	2 3	14·15

Results.—The indicator diagram from both ends, (No. 1 being the bottom,) is a fair average of those taken during the time for which the foregoing particulars are noted. Boiler pressure, 21 lbs.; vacuum per gauge, 23¾; revolutions, 14¼ per min.; hot well, 120° Fahr.; time, 10 hs. 54 min. A. M., Sept. 7. It will be seen that both on the steam and vacuum side, the pressures are fully maintained in the cylinder. The calculated mean pressure for this diagram is 19·25 lbs. per square inch, exerted continually.

Slip of the Wheel.—Total number of revolutions from Ledge Light Boat to Navy Yard, ... = 4,216

Distance traversed by centre of pressure of wheel is, then, 4,216×92·86 . . . . = 391,507 feet.

Distance run (through the water, after deducting for effect of tide), is 67·05×5280 . . . . = 354,024 "

Slip = 9·57 per cent., . = 37,483 "

There being no doubt of the correctness of the above data, both as to distance run and the revolutions made, which were carefully noted from the register, the small amount of slip must be attributed to the fineness of the model of the ship, and the large paddle surface immersed.

The model is an improvement over that of the *Keystone State*, by the same builders, which vessel was built from a model furnished by John W. Griffith, Esq., Naval Architect, but necessarily modified somewhat to suit circumstances. The *Quaker City's* model very nearly approaches that originally furnished by Mr. Griffith. Its peculiarities are, sharpness forward, amidship section aft of the centre of length, full after lines, water lines hollow forward, bilge rather square, floor perfectly flat, and carried well forward and aft, and great shear forward.

Resistance of Hull.—The loss by oblique action of the paddles is equal to 18·70 per cent., leaving $81\frac{3}{10}$ per cent., of the net power transmitted through the shafts to be applied to propulsion.

Calling A = area of cylinder in inches	=	5675
P′ = mean pressure on piston, through stroke	=	19·25
P = mean effective pressure, deducting $1\frac{1}{2}$ lbs. for working engine, and 5 per cent. on the remainder for friction of load	=	16·86
$(1-\sin.^2\delta)$ = per centage of loss by oblique action	=	·187
$\sin.^2\delta = (1-\cdot187)$	=	·813
L = length of stroke in feet	=	8
D = effective diameter of wheel	=	29·56
R = average revolutions per minute	=	14·15
S = slip	=	·096
C = coefficient of traction.		

$$\text{Then}^* C = \frac{A\ P\ L\ \sin.^2\delta}{\cdot0043\ D^3\ R^2\ (1-S)^2} = \frac{5675\times16\cdot86\times8\times\cdot813}{\cdot0043\times25829\times200\cdot2\times\cdot817} = 34\cdot25;$$

That is, the mean velocity being exactly 13·50 statute miles per hour, or 19·8 feet per second, the power constantly applied to propel the vessel at that speed was $34\cdot25\times19\cdot8^2 = 13432$ pounds, and the horse power exerted was $\frac{13432\times19\cdot8\times60}{33000} = 483\cdot77$ horse power.

Proportion of Power Utilized.—The gross power developed by the engine was $\frac{2\,A\,P'L\,R}{33000} = \frac{2\times5675\times19\cdot25\times8\times14\cdot15}{33000} = 749\cdot5$ horse power; Therefore, 749·5 : 483·77 : : 1 000 : 0·645, or $64\frac{1}{2}$ per centum of the gross power was utilized, the distribution being as follows:

		Horses power.	Per cent. of whole power.
Consumed in	working engine,	58·40	7·80
" "	friction of load,	34·56	4·60
" "	oblique action of paddles,	122·00	16·30
" "	slip of wheels,	50·67	6·80
" "	propulsion,	483·77	64·50
	Totals,	749·50	100·00

So soon as the ship shall have made a trip from this port to Charleston, burning soft anthracite, I shall publish her steam log, in order to show the steaming capabilities of her boilers.

* Vide Vol. xxiii, p. 412.

For the Journal of the Franklin Institute.

An apparatus for Organic Analysis by Illuminating Gas, and on the use of this Gas in Experimental Laboratories. By Charles M. Wetherill, Ph. D., M. D.

(Continued from page 115.)

On Gas as a source of Heat in the Laboratory.

This agent has become so necessary in the cities where it may be obtained, and its applications are so simple and so self-evident, that a description of the different apparatus for its use seems almost superfluous; nevertheless, the advantage to those who may desire for the first time to employ it, tempts me to communicate the results of my experience.

A very simple burner for table use, and which every one may make for himself, was shown to me about two years ago by Mr. Tilghman, who has employed it for some time. It is simply a spiral of brass tubing of the smallest diameter offered in commerce, and which being closed at one end, is bent to form a spiral with a straight piece of six inches in length at its commencement, and so that the diameter of the spiral (of say three turns) is about two inches and a half. Small holes are drilled at a half an inch apart with a needle in the manner indicated in a former part of this article. The burner thus formed, is surrounded with a cylindrical chimney of sheet brass about eight inches high, held together with five or six rivets, and of such diameter that when the burner is placed in its centre, it shall have a space of half an inch around it for circulation of air to prevent the flames from smoking. Three pieces of two inches and a half high by one and a half wide are cut from the bottom of this chimney, and a small slip of each part thus cut away is left, so that it may be turned up on the inside to support the burner. It thus forms three legs for the chimney to stand upon, and three open spaces for the air to enter from beneath to reach the flame. The top of the chimney is serrated, the points being half an inch apart and forming equilateral triangles; this enables the body to be heated, as a capsule, water bath, &c., to rest upon the top of the chimney, and the hot air and products of combustion are diffused equally upon all sides through the openings thus formed. I have used these burners for some time and find them very practical, giving nearly as much heat as the so-called gas stove, to which they are for most purposes preferable. A platinum crucible placed upon the top by means of a triangle is heated sufficiently for incinerations, which take place slowly, though giving a very white ash. Mr. Tilghman, in certain experiments with which he was occupied, was enabled with such a burner, by using a chimney several feet in length, and placing the object to be heated in the inside, near to the flame, to keep a crucible at a full red heat for several days. Of course the spiral may be made of greater diameter, but the above proportions will suffice for most purposes. The straight end of the spiral is supported by a rest or foot made by bending a piece of sheet brass around it, and receives gas from a vulcanized caoutchouc tube, communicating with the service pipe.

Burner Holder.

A variety of differently shaped burners is often found useful on the laboratory tables, though certain ones are used almost exclusively; it is a

desideratum to be able to change these rapidly without any unscrewing, and above all, when working at night, to be able to get a good light on any of the tables and at any height. I have used for this purpose, a burner stand of the following description, and which seems to accomplish all that can be desired:

A piece of brass tubing of $\frac{5}{8}$ths diameter and $3\frac{1}{2}$ inches long, is closed at the bottom, where, by means of a screw, it may be attached to a circular foot; just above where it is closed, another screw connexion is made with a piece of $\frac{3}{8}$ tube of five or six inches in length, which delivers the gas from a caoutchouc tube, connected with the supply cock. The upper part of the $\frac{5}{8}$ vertical tube is widened and has a cap with a hole in the centre screwed upon it; a cork, perforated to suit the size of the tube which carries the burner, is placed in the top part of the vertical tube, and the cap screwed down tightly upon it. By this means the different tubes which carry the burners, and which tubes are all of exactly the same diameter, ($\frac{1}{4}$ inch external,) may be readily inserted or withdrawn, and admit of adjustment under the object to be heated by a vertical motion through a play of $3\frac{1}{2}$ inches.* It is of advantage to have the lamp thus disconnected from the retort stand which supports the body to be heated, but it is sometimes necessary to have it otherwise, in which case, by unscrewing the foot and the tube, which delivers gas into the burner holder, this tube may be fixed in the clamp sliding upon the retort stand, and the burner holder being again connected, the required object is obtained. The burners usually employed in these stands are the Argand, with a chimney $2\frac{1}{2}$ inches high, formed of sheet brass riveted together. I have found brass better for this purpose than either tinned iron, copper, or iron; some that have been in use for three years, have the surface smooth and not in the least scaled off, though dark in color. When required to raise a crucible to a full red heat, or to heat strongly a florence flask or other object, I convert this burner into a gas stove, by simply placing a piece of wire gauze upon the top of the chimney. It increases the heat, and prevents the disturbing influence of currents of air so troublesome when using the gas stove to rest upon the top of the wire gauze, another chimney of the same size, but cut in points where it touches the gauze to admit air. I find this mode of employing the flame so practical, that I never use the gas stove.

I have tried a variety of differently shaped burners for the mouth blowpipe, but the most effective appears to be one that is known by the name of Solliday's patent, and is a burner proposed for illuminating purposes. The burner is a single cut, and the patent consists in a brass sheath slipping up and down along the nipple of the burner, and which sheath is so cut away as to raise flame upward when it is elevated; it is supposed that it consumes a less quantity of gas for the same light when the sheath is thus raised. The advantage for the blow pipe arises from the base of the flame being very much thickened when the sheath is raised, and the point of the blow pipe rests in the notch of the sheath, thus enabling an

* I have noticed in the last edition of "Quekett on the Microscope," in the Appendix, an achromatic gas lamp for the microscope, which has a stand very similar to the one here described, but with packing in a stuffing box instead of a cork, which prevents the burner being changed without unscrewing.

excellent flame to be obtained, whether for oxidizing, or reducing. The same burner, of course, is used for lighting the laboratory. By means of the burner stand, light may be obtained on any of the tables, with a very few burners; some of these are attached to long tubes (of $1\frac{1}{2}$ to 2 feet) to enable the light to be elevated in the neighborhood of any elevated apparatus that may be in operation, while others are of the usual length of six inches, which brings the light very close to the table. Various burners are used in the burner holder, such as those made from a tube bent into a ring, and with holes made with a needle, for preventing concussion in distilling and evaporating certain substances, for filtering hot, &c. The funnel may be heated for this purpose, by cutting a piece of sheet brass into the shape of a funnel and riveting it together. A circular tube burner, with only four equidistant holes, fits a little above the bottom of this brass funnel, which it heats to any required degree, and also the glass funnel which rests therein. This method is especially suited for small funnels.

The blow pipe table, which is used quite extensively in this city, both in laboratories and in the arts, consists of a square tin box encased in a wooden one, and into which air is forced by a condensing pump worked by the foot. The most convenient tables have a contrivance like that described as the burner holder, which enables the air jets to be readily changed, elevated, or depressed, as may be required.

For fusions with the table blow pipe, the burner is the usual Argand one, the opening of which has fitted to it by friction, a brass cylinder pierced with holes around its circumference; the other end of the cylinder is attached to the brass tube, which slides into the holder delivering air from the reservoir, and the burner is connected with the supply cock by a caoutchouc hose and gallows screw. Where the greatest heat is required, two Hessian crucibles, with the bottoms broken out, serve as a jacket to enclose the platinum crucible.

For glass blowing, I use a burner which answers all the purposes of the ordinary tallow lamp, and with as good effect. It is a flattened cylinder made by brazing together a piece of sheet brass, and is four inches in height. It is fixed vertically to a foot of brass, heavy enough to give it a stable position. It is closed at top by a piece of brass of elliptical shape, and of which the major axis is $1\frac{1}{2}$ inches, and the minor axis $\frac{7}{8}$ths of an inch; this is pierced with seven rows of holes a little over $\frac{1}{16}$th of an inch apart. The bottom of this cylinder is closed, and receives the gas through a short brass tube connecting with the service pipe by a caoutchouc hose and gallows screw. The blow pipe nozzle is made from a tube of difficultly fusible Bohemian glass, of half an inch in diameter, which must be formed by being held in the flame until the sides fall almost together, and then drawn out so that the orifice for the air jet is small, and for a short distance almost cylindrical; this is important to obtain a long flame. The glass nozzle is fitted by a perforated cork to a short brass tube bent at a right angle, and which fits the stuffing box, delivering air from the reservoir. By this means the requisite adjustment of light may be effected, and if the glass tip be properly made, a beautifully pointed horizontal flame, of a foot in length, may be obtained. Of course, by removing the burner a little in advance of the jet, the brush

flame may be formed, and which is of a size sufficient to blow bulbs large enough to determine the specific gravity of vapors by Dumas' method. A jet for giving a larger and more widely spread brush flame for blowing larger bulbs, and bending thick tubes, is made by hammering together (after annealing) the end of a $\frac{3}{8}$ brass tube, and then, filing down the end until a fine slit appears; this is silver-soldered to another tube bent at right angles, which fits the aperture in the jet holder, and so that the slit is in a horizontal plane. The air passes out of the slit across the flame, spreading it out into a wide brush. By means of the blow pipe burner here described, many little articles may be silver-soldered, and I have found the long pointed flame invaluable for blow pipe experiments; thus obviating the inconvenience of the mouth blow pipe. It gives also a very good reduction flame for such experiments.

Cupellation with the Tube Blow Pipe.

Professor Booth states in his *Encyclopedia of Chemistry*,* that by driving the current of air (from the table blow pipe) obliquely and somewhat downward, through the Argand burner, the process of cupellation may be accurately performed on 20 grammes of lead.

The following are the results obtained in cupellation with the gas blow pipe lamp described above.

A hessian crucible, without bottom, is supported horizontally upon a retort stand in front of the burner, and inside, in the middle resting on the side of the crucible, is placed the cupel. The brush flame from the burner, using the slit nozzle, is blown into the mouth of the crucible, where it heats the cupel and is reverberated upon it from all sides. The bottom of the crucible being arched, the flame keeps even the back part of the cupel at a sufficient temperature. It is well to place a fragment of a porcelain crucible in front of the cupel to prevent it cracking by the direct action of the flame. The different circumstances to be attended to in cupelling, are thus entirely under the control of the operator. By regulating the stop cock, which supplies the gas, and by varying the pressure and quantity of the air, the flame may be made oxidating or reducing at will, and the heat may be suddenly raised or lowered as the conditions of the experiment require. This method promises, at least, an equal accuracy with that usually employed, and for one or two experiments, is, I think, preferable. In the second experiment, the cupellation lasted exactly a quarter of an hour from the time of lighting the gas. And thus the per centage of silver in a coin, may be ascertained within about twenty minutes.

The cupellation was performed upon a half dime of 1853, half of which was taken for each experiment. In the first analysis, the lead was taken purposely in excess, to observe the working of the experiment.

First Experiment.

Weight of half the coin, 0·6735 grammes; lead, 7·3; resulting button of silver, 0·602 grammes, or

Silver,	89·384
Copper,	10·612
	100·000

* Article, Blow Pipe Table.

Second Experiment.

The lead was here taken according to d'Arcets' Table. Weight of second half of coin, 0·553 grammes; lead, 3·871; resulting button, 0·49625, or

Silver,	89·738
Copper,	10·262
	100·000

This result comes within $2\frac{1}{2}$ thousandths of the theoretical amount of silver.

Distillation.

The still in my laboratory is heated with gas. It contains seven gallons of water when filled to the proper degree for distilling, and will prepare distilled water at the rate of a gallon an hour, with the burner now in use. This still was originally set in a furnace for being heated with anthracite coal; to prepare it for gas, no other alteration was made than to place a damper in the chimney. The burner is a $\frac{3}{8}$-inch brass tube, bent in a circle of 12 inches diameter, and resembling a wheel with eight spokes; the gas entering these where they join in the hub or centre. Holes are drilled along the spokes and around the circumference of the wheel. The gas thus burns in small jets, and the burner is placed in the furnace about $2\frac{1}{2}$ inches distant from the bottom of the boiler. I have never actually measured the gas used by this burner, but I infer from other experiments, that it is within 25 feet an hour, which would make the cost of a gallon of distilled water under five cents. Seven gallons of water begin to boil in almost a half an hour after lighting the burner; and as the heat is equally diffused over the surface of the boiler, the ebullition is quite tranquil, which conduces to the purity of the water. The furnace, besides retaining the heat and saving thereby, enables other boilers to be placed in it for various experiments of distillation, and heated by a stronger heat than gas, if required. For this purpose, the top of the furnace is of cast iron with a circular aperture, in which the boiler fits and is supported by a flanch.

Sand Bath.

The sand bath is also heated by a burner of exactly the same shape and size as for the still. This sand bath was also intended, originally, to be heated by fire, under the fore part of it, and is, together with the wind furnace, enclosed in a cast iron frame, or hood, with windows. The aperture in the bed-plate for the reception of the sand boxes, is 3 feet 3, by 19 inches. In this opening, resting on their flanches, are two sheet-iron boxes for the sand, each occupying the half of it. One of the boxes is plain, the other has a well in the centre, of 12 inches in diameter, formed by a cylindrical piece of the same height with the sides of the sand box, and riveted around a corresponding aperture in the bottom. Around this well is sand, for the reception of small vessels; and a circular sand bath fits in the well, and may be removed to give place to a large capsule, or to a large water or oil bath, which may be required to be submitted to the direct action of the heat. Either of the two sand boxes thus formed being movable, may be placed in front directly under

the source of heat, as circumstances may require. The gas burner is so placed, that when the box with the well is in front, the burner is directly under this well. The heated air passes along a flue, of three inches in height, formed by the bottoms of the sand bath, and slabs of fire tile, which form the roof of an oven, of the dimensions 2 feet 3, by 2 feet 4, by 21 inches in height. At the back of this flue, the heated air may, by dampers, be either passed directly into the chimney, or thrown down into the oven, where it makes the circuit of the floor through square stove-pipes, whence ascending to the roof of the oven, it escapes into the chimney. In this oven is a thermostat for regulating a separate burner, which heats it when the sand bath is not in action, and which is thus independent of it. I have places under the sand bath for two large circular burners, but have found one, so far, sufficient. The heat is sufficient for all purposes to which the sand bath is applied.

For the Journal of the Franklin Institute.

Notes on the Pacific Mail Steamship Company's Steamer "Sonora." By Wm. H. Shock, Chief Engineer, U. S. N.

The above named steamer was lately built and fitted for the Pacific Mail Steamship Company, and adds one more to the number constituting that successful line of vessels in the Pacific, under the management and direction of Wm. H. Aspinwall, Esq., of New York.

In this case (as with all the vessels belonging to this line,) no expense or pains have been spared to make her (for speed, safety, and comfort,) what a traveling community requires.

They have now in successful operation, the following steamers, viz., "*John L. Stephens,*" "*Oregon,*" "*Golden Gate,*" "*Panama,*" *and* "*Sonora.*"

The "*Sonora,*" after having made a successful trial trip, left New York for the Pacific, March 11th, 1854, via Rio and Valparaiso, and by reference to the annexed log, nearly all the particulars of her run from New York to Rio will be seen. It is, however, not as full and complete as is desirable, in order to ascertain the real efficacy of the ship, as no mention is made of the extent of opening of the throttle valve, the state of the wind and sea, with its effect upon the working of the ship, and last, but by no means the least important items neglected, were Indicator Diagrams; from which *only*, can the power and efficiency of the engines be satisfactorily determined. Indeed, as it is truly remarked by a writer on the instrument, "In the hands of a skilful engineer, the Indicator is as the stethoscope of the physician, revealing the secret workings of the inner system, and detecting minute derangements in parts obscurely situated;" and it is to be regretted that it is not more generally used; as with it we can determine defects, both in the design and working of the engine, if any exist, and with carefully kept "logs," as well as carefully taken diagrams, with known dimensions of ship, engines, and boilers, a tabulated form of engines, boilers, &c., to the hull, might be established, whose accuracy would be based upon practical observation.

Steam Log of the Steamer Sonora, from New York to Rio Janeiro, 1854.

DATE.	Aver. Steam.	Aver. Vac'm.	Aver. Revs.	Aver. Tem. of H. W.	Grade of Ex.	Ashes. Lbs.	Coal. Lbs.	Density of water.		Dip of Paddles.
Mar 11,	14	23	9·4	115	2-5	1,053	17,555	$\frac{1}{8}$	$1\frac{1}{8}$	7 ft. 2 ins.
12,	14	23	9·4	116	"	6,357	40,344	$\frac{3}{8}$	$\frac{3}{8}$	at N. Y.
13,	17	23	10	126	"	11,025	48,152	$\frac{5}{8}$	$\frac{5}{8}$	5 ft. 1 in.
14,	$18\frac{1}{3}$	24	10·9	126	"	5,774	55,143	$\frac{7}{8}$	$\frac{7}{8}$	at Rio
15,	19	$24\frac{1}{4}$	10·3	126	"	4,940	53,777	$1\frac{1}{2}$	$1\frac{1}{2}$	Janeiro.
16,	$19\frac{1}{2}$	24	11 8	126	"	5,800	53,180	$1\frac{1}{2}$	$1\frac{1}{2}$	
17,	$19\frac{1}{2}$	24	12 2	128	"	5,213	45,709	$1\frac{1}{2}$	$1\frac{1}{2}$	
18,	$17\frac{1}{2}$	24	11·6	128	"	5,100	50,903	$1\frac{3}{4}$	$1\frac{3}{4}$	
19,	18	24	12	128	"	5,564	57,222	$1\frac{3}{4}$	$1\frac{3}{4}$	
20,	20	24	12·3	120	"	5,072	48,318	$1\frac{5}{8}$	$1\frac{5}{8}$	
21,	19	24	12·4	128	"	8,848	55,602	$1\frac{5}{8}$	$1\frac{1}{2}$	
22,	20	25	13·3	130	"	9,296	58,012	$1\frac{5}{8}$	$\frac{3}{8}$	
23,	17	25	12	128	"	8.848	52,640	$1\frac{5}{8}$	$\frac{1}{4}$	
24,	$13\frac{1}{2}$	25	13	125	"	8,960	57,648	$1\frac{3}{4}$		
25,	15	25	13·4	126	1-5	8,965	56,848	$1\frac{3}{4}$		
26,	15	25	13·8	128	"	9,074	58,974	$1\frac{3}{4}$		
27,	18	25	13·6	130	2-5	8,968	57,271	$1\frac{3}{4}$		
28,	17	25	13	130	"	9,128	44.422	$1\frac{3}{4}$		
29,	$12\frac{2}{3}$	24	15·4	130	"	20,844	48,865	$1\frac{3}{4}$		
30,	17	24	15·5	130	"	10,082	55,975	$1\frac{3}{4}$		
31,	17	24	16	130	"	9.752	62,680	$1\frac{3}{4}$		
Aprl 1,	19	24	15	130	"	10,640	64,000	$1\frac{3}{4}$		
2,	15	23	15	130	"	10,864	55,729	$1\frac{3}{4}$		
3,						7,280	33,000	$1\frac{3}{4}$		

Left New York, March 11th, at 1 o'clock P. M.; arrived at Rio, April 3d, at 9·40 P. M.; whole time, 22 days, 8 hours; running time, 21 days, 23 hours.

Whole number of revolutions, . .	403,051
" amount of coal expended, . . .	$556\frac{1}{2}$ tons.
" " oil " . .	79 gals. 3 qts. $\frac{1}{2}$ pt.
" " tallow " . .	60 lbs.
" " india rubber, . .	25 "
" " waste " . .	50 "

REMARKS.—Owing to our condenser working so well, we found it unnecessary to blow our boilers until we were six days out, when we altered our regulation somewhat, feeding all fresh water in port boiler; surplus of fresh in starboard. We required to blow starboard boiler 22 minutes, on an average, per watch of 4 hours, in order to keep our water at $1\frac{3}{4}$. On examining boilers we found port boiler free from scale; starboard boiler with about 1-32 of an inch of scale. On arriving in port, engines and boilers in good condition.

As regards the working of the patent condenser, I am happy to say it has given every satisfaction. I have also ascertained how long it required to fill our fresh water tank with an average pressure of 19 lbs. of steam, engines making 15 or 16 turns; it took 22 mins. Dimensions of tank, 8 ft. long, 4 ft. deep, and 4 ft. wide. We allowed it to hold 1000 galls.

The "*Sonora*" is a hermaphrodite brig-rigged vessel, of the following dimensions, viz.:

Length on deck, . . .	270 feet.
" of keel, . .	264 "
Breadth of beam, . . .	36 "
Depth of hold, . .	24 "
Tonnage, . .	1580.

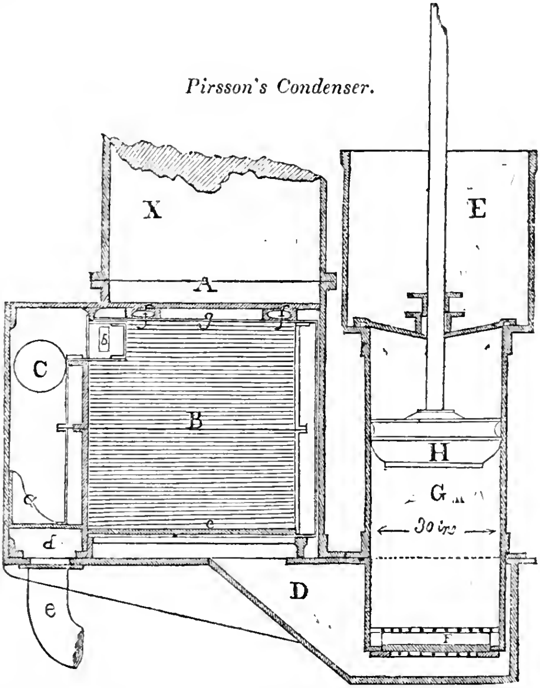
And is supplied with two top beam engines, from the Morgan Iron Works, New York, of the following dimensions:—

Diameter of cylinder, . . .	50 inches.
Stroke of piston, . . .	10 feet.
Diameter of air-pump, . . .	30 inches.
Stroke of air-pump, . .	57 "
Diameter of water wheel, . . .	30 feet.
Face of water wheel, . .	9 feet 6 inches.

She is supplied with *one* of Pirsson's Surface Condensers, under starboard engine, and an ordinary jet condenser under port, and so connected as both to be worked by one air-pump, if necessary.

It will be observed, that the "Surface Condenser" worked well, and gave entire satisfaction.

Pirsson's Condenser.



A, Flanch to receive cylinder.
B, Tubes.
C, Exhaust pipe.
D, Bed plate channel.
E, Reservoirs.
F, Foot valve.
G, Air pump.
H, Air pump piston.

a, Division plate at bottom of exhaust box.
b, Equilibrium openings.
c, Tubes to conduct fresh water.
d, Fresh water reservoir.
e, Suction to fresh water pump.
f, Injection holes.
g, Strainer for injection.

Her boilers are of the ordinary "up return flue" variety, and gave good results on her trial trip, (natural draft,) but since her arrival in the Pacific, they find that in consequence of the light airs and calms, which prevail on their route near land, much trouble is experienced in getting steam, and this fact presents the best reason for supplying steamers destined to the Pacific, with blowers.

A slight accident occurred to the *Sonora*, on her passage to Panama, while passing through the Straits of Magellen, in consequence of the guard over the foot valve F in bottom of the starboard air-pump being deranged, the air-pump piston-rod was bent, rendering it necessary to disconnect it for a few hours, until the requisite repairs could be completed; during which time, *both engines* were in operation, consequently *both* condensers, with but one air-pump, which performed the work

required for both engines; and strange as it may appear, *the vacuum per gauge showed a diminution of only $1\frac{1}{2}$ inches, or an increase of $\frac{3}{4}$ lbs. back-pressure*, everything remaining the same as before the accident, as to steam, revolutions, &c.

These remarkable results I conceive to be attributable exclusively to the fact of the air-pump being placed so low down in the channel-way, as seen by the annexed drawing of the arrangements. It also shows in this particular case that the engines are over-loaded with air-pump, although designed accurately to the proportions usually given.

For the Journal of the Franklin Institute.

Thoughts on the Caloric Engine. By Thomas Ewbank, Esq.

(Continued from page 184.)

If any reliance is to be placed on the cardinal doctrines of physics, a mechanical effect can never be repeated at less than its first cost. There are no variations in nature's prices of force; nor is there such a thing as planting a certain amount in a machine, like seed in soil, and reaping from it an increase; yet, that is what is attempted in perpetual motions, and is alleged to be realized in the Caloric Engine. If the allegation, incredible as it is, turn out true, the engine infinitely surpasses all previous acquisitions in science and art; but if it do not establish, what is called its grand principle, the *repetition of force*, we presume it will, from the excitement it has caused, the converts it has made among professional men, including both statesmen, heads of departments, and savans, be associated with kindred hallucinations of former times.

There are axioms in mechanics, as in morals, mathematics, and other sciences, which serve as touchstones; so that propositions conflicting with them, however specious in appearance, may safely be rejected. It needs no process of reasoning to show that two and two make four, nor of experiment to prove that action and re-action are inseparable and equal; and hence, when Captain Ericsson announced that in his air-engine he repeatedly used the same power, many persons at once concluded (since that was equivalent to saying, he obtained action without re-action, and power without cost,) that he was mistaken; and that his error was as gross, though it might not be as apparent, as any of the well known attempts at perpetual motion. If he has not contemplated heat as a source of force irrespective of its vehicle, has he not forgot that force is only available *while re-acting* against some resisting body, and that without this, it must be, to all mechanical purposes at least, latent. A quantity of heat sufficient to overthrow a mountain, might be concealed in a piece of floating down, and yet the force locked up in it could not displace a fly till developed by re-action. A giant standing in the atmosphere, supported, as the saying is, upon nothing, could not lift a tumbler of water from a table, because he would have nothing for his feet to rest or re-act on; and just as impossible would it be to get heated air from the regenerator into a cylinder a second any more than the first time without an external base to start it from. Unless Capt. E. can leave the heat lying *perdu* at the bottom of the cylinder, we do not see how, when once out, it can be got in again without an outlay of force equivalent to it, since it has to be

sent in with air, and the base of re-action for that air is the piston of the feed pump. We may be mistaken, but it does seem as if the law of action and re-action had been overlooked, or that it was thought to be neutralized by, or lost in, the secret phenomena of heat, or that it was rejected along with received doctrines on the mechanical relationship of heat to force.*

The origin of the engine, as given by Sargent, is highly characteristic of it:

"The late Professor *Harvefeldt* of Sweden, one of the first mathematicians of the day, stated, in a public lecture, not many years ago, that there is nothing in the theory of heat which proves that a common spirit lamp may not be sufficient to drive an engine of an hundred horse power. It will readily be believed that the Professor had but few hearers who did not smile at the suggestion; but among those few, we may number Ericsson, who, from the earliest period of his mechanical labors, had been in the habit of regarding heat as an agent, *which, while it exerts mechanical force, undergoes no change.* This extraordinary fact, Ericsson exemplifies, by a simple but conclusive illustration; for the readier reception of which, by the audience, it will be well to introduce particular dimensions. Suppose the piston of an ordinary steam engine cylinder to be at the bottom, and suppose the force of the steam intended to be admitted into this cylinder under the piston to act with the force of 100,000 pounds, which is the force on a piston of 50 inches diameter, acted upon steam of 50 pounds pressure to the square inch. Suppose the cylinder to be ten feet long, and the piston to be loaded with a weight equal to these 100,000 pounds. If, now, a sufficient quantity of steam of the stated pressure be admitted from below the piston, this load will be elevated through the whole length of the cylinder; and hence we shall have raised a weight of 100,000 pounds through a space of ten feet. But who will contend that this immense amount of mechanical force has required any *expenditure of heat?* Does not the steam, after having lifted this weight, contain just as much heat as it did before leaving the steam boiler, less only the losses by radiation? And does not that heat retain all the properties *after* the operation which it possessed *before?* Am I, then, incorrect in stating that we have obtained this power without changing the nature, or diminishing the energy of the heat employed?

"But, although nature has furnished us with an agent of such extraordinary properties for the production of mechanical force, how imperfectly do we employ it! In the low-pressure engine we turn the steam, after having performed its good office, into a condensing apparatus, where the heat is in a manner annihilated; and in the high-pressure engine, we throw it away into the atmosphere. Yet men, even of mechanical distinction, ridicule the idea of superseding the steam engine; and science seems to pause contentedly in the contemplation of its admitted perfection." * * * * "From what I have already stated, it will be readily inferred, that the principle forming the basis of the *Caloric Engine,* is that of returning the heat, at each stroke of the piston, and using it over and over again."

Why the fact that heat in a cylinder is the same after as before pushing up a piston should be so conspicuously pointed out as an 'extraordinary' one, we do not see. May not the same be said of every motor? Does wind undergo any change 'whilst it exerts mechanical force' on the sails of a ship? And does not the Croton water 'retain' in the city of New York 'all the properties which it possessed before' it reached, in its rural channel, those grist and factory mills whose wheels it drives round? And if, *because* heat experiences no change in air or steam cylinders, it can be used over and over indefinitely, why not wind and water also? 'Ah!' some one replies, 'because in that case you would have to *carry back* those fluids after they had once acted, and place them in a proper position to do their work over again.' Exactly so, and so must Captain Ericsson with his heat. As respects it, he mistakes quality for position. It will act again when he takes it back and replaces it in

* See postscript, where it appears to be repudiated, and where it is admitted, if it be true, the caloric engine very much resembles the perpetual motion.

a proper condition to act, just as will wind, after driving a windmill, or water, after acting on the piston of a pressure engine; but as with them action and re-action would balance each other, it would take as much power to get it back as it could then give out. Had he, in his early labors, regarded heat as an agent, which, whilst it exerted mechanical force, acted on one body without equally impinging or butting against another, and had he recently proved and exemplified it 'by a simple but conclusive illustration, that would have been truly extraordinary,' *and to the point.*

It is not necessary to be acquainted with all or half the working parts of the caloric engine, to comprehend how the principle it is based on is attempted to be carried out. Let us take one of the four large cylinders standing over its fire,* its feed pump, and a regenerator between them. It will be sufficient to understand the action of these; all else are intermediate links or accessories. Suppose the feed pump set at work by some external force, as it must be at first, and drives a charge of air into the lower part of the working cylinder; the fire beneath expands the air, the piston is then pushed up by it, and motion communicated, as in steamboats, to the crank that carries round the paddle wheels. The piston next descends, driving the heated air beneath it through the regenerator into the open atmosphere. The feed pump, now worked by the engine, drives forward another charge of air, sending it through the regenerator, where it takes up and bears into the cylinder the heat left in it by the previous charge on passing through. The working piston is again raised, again the air escapes through the regenerator, leaving its heat within, and again a fresh charge bears it back to the cylinder, where, receiving an accession from the furnace, the piston is again raised, and so on.

A careful examination of the circumstances attending a few strokes of the working piston, ought to show the truth, if it be in the caloric engine, and if not, to point out where the error lies. We think it will. It has led us to the following propositions and conclusions:

1. The efficacy of the engine is due to the quantity of air dilated within the working cylinder, and to the extent of its dilation; that is, the denser the air injected, and the greater the heat imparted to it, the more power it will have.

2. If unheated air were employed, if neither fire nor furnace were used, the engine would have no power, because no expansion could take place within the cylinder.

3. If heated air were employed, that is, heated before, and not after its injection, the engine could have no more power than with cold air, and for the same reason.

4. Its motion, then, depends on increasing the temperature of the motive fluid *after* it has entered, or virtually entered the working cylinder; no previous expansion can be a clear, or any gain; 1st, Because it is purchased with a corresponding outlay of power on the feed pump, not that a heated charge requires more power to inject it than a cold one, but because there is less air in it. Equal volumes require equal power, but not equal quantities. A charge doubled in volume by heat, would require double the power to introduce it; but, as we have seen, the power of the engine depends on the quantity dilated *within* the cylinder,

* These closely resemble those steam engines in which the boiler and cylinder are combined; the lower part of the latter being embedded in the fire.

not without; 2d, Because heated air undergoes less expansion when it arrives within the cylinder, than if it had not been heated. In other words, the power depends on the quantity taken up *directly from the furnace*, for it is the hot air *in* the cylinder that does the work; the rest, whether in the regenerator, feed pump, receiver, or passages between them, simply serves as a re-acting medium till the cut-off confines the reaction to the bottom of the cylinder. Hence, when the caloric engine ceases to take up *fresh heat* from the furnace, it must cease to give out *fresh power*.

5. As it is said to be possible, let us suppose the *whole* of the heat arrested and returned by the regenerator; the engine would then be a full realization of its author's views, and of those of Harvefeldt. It would demonstrate that a common table lamp would do work equivalent to an hundred horse power, and even more! *i. e.*, its friends would expect it to do this: nothing less would fulfil their predictions. Now, seriously, could it have any power at all? Could it move at all? Beyond controversy, not. As no expansion could take place within the cylinder, just as much power would be required to send a charge in, as it could give out when in. The condition of things would be precisely as in proposition 3.

6. It may, perhaps, be contended that the regenerator is virtually a part of the working cylinder, and that the reasoning about a diminution of injected air, in consequence of its being heated on the way, is fallacious, inasmuch as the feed pump always receives and delivers its full charge of cold air. Admit this, and the aspect of the case is not changed. Because the pump drives forward its contents at every stroke, it does not follow that they all reach the furnace or place of expansion; we know they do not. The regenerator is a capacious chamber, and a quantity of air equal to its capacity and connecting passages, never gets into the cylinder. The cold air sent through the regenerator by the first half of the pump's stroke, bears off to the cylinder the greater part of the heat lodging in the wires; that sent in by the other half takes up less and less, the latter portion probably none, or next to none. Now, unless this last air goes forward to be heated, its presence is of no account. How is the fact? Why, instead of being sent on to the furnace, it is discharged at the end of the stroke; *i. e.*, almost as soon as it enters; consequently without performing any useful service whatever. It constitutes a virtual prolongation of the re-acting base of the feed pump's piston, but that is attended with a loss of power, not a gain. Hence, if the regenerator is virtually a part of the working cylinder, it is an unprofitable one, to say the least, since, upon it is spent, without return, the latter and most efficient part of the feed pump's labors. To it is to be ascribed the difference in quantity between air supplied by the feed pump and that which reaches the working cylinder, whatever that difference may be.

(To be Continued.)

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, September 21, 1854.

John Agnew, Esq., President, pro tem., in the chair.
J. Vaughan Merrick, Esq., Corresponding Secretary, pro tem.
Isaac B. Garrigues, Recording Secretary.

The minutes of the last meeting were read and approved.

Letters were read from The Maryland Institute, at Baltimore, Md., Ayres Stockly, Esq., of Ontanagon, Mich., and Wm. H. Shock, Esq., Chf. Eng. U. S. Navy.

Donations to the Library were received from Hon. Charles Mason, Commissioner of Patents, Washington City, Messrs. Robert C. Walker, A. Pollock, Dr. L. Turnbull, Dr. B. H. Rand, and Robert Riddell, of Philadelphia.

Donations to the Cabinets—Specimens of copper ores, &c., from the Indiana Mine, Daniel Beaser, Esq., Superintendent; also, from the Douglass Houghton, and the Fire Steel Mines, Joseph Coulter, Esq., Agent, Lake Superior; and a specimen of wood bent into a hoop by machinery, from Wm. H. Shock, Esq., Chf. Eng. U. S. Navy.

The periodicals received in exchange for the Journal of the Institute were laid on the table.

The Treasurer's statement of the receipts and payments for September, was read and approved.

The Board of Managers and Standing Committees reported their minutes.

New candidates for membership in the Institute (4) were proposed, and the candidates (3) proposed at the last meeting, were duly elected.

Mr. J. Vaughan Merrick exhibited a specimen of wood, bent in a circular form by the "Ship Timber Bending Machine," presented to the Institute by W. H. Shock, Chf. Eng. U. S. Navy. He stated that this machine was the invention of Mr. Blanchard, well known as the inventor of the gun-stock, and last turning lathes; and that its operation was based on the principle of end pressure, preventing the fibres of the convex side of the wood from extending, and thereby breaking, while the fibres on the concave side, are compressed. He also stated, that the Company, having the sole right to use them, had erected an establishment at Greenpoint, L. I.; that they had two machines now in use, one for ship-timbers, or futtocks, and one for bending frames for furniture, and ships' knees. In the former of these, the timber is bent laterally to the required form, which is taken off the moulding floor, in a flexible frame. It consists of two tables, hinged with each other, and pierced with slots, through which are bolted the dogs, secured to the timber to be bent. The timber, after it has been steamed, being placed against these dogs and upon a band of iron, has end pressure applied to it by a screw. By powerful gearing, the two ends are then drawn around in opposite directions, the iron band retaining the end pressure, while it bends with the timbers. When the required shape is attained, a brace is applied tying together the ends, and it is then removed from the machine, and allowed to harden for some days.

The smaller machine for ships' knees, &c., has a horizontal mandril, carrying a head, oval, circular, or of any other shape to which it is desired to bend the wood; beneath this head, and secured at one end to one side of it, the wood is placed on an iron band, end pressure having previously been applied; the other end of the wood is then secured to the table, on which the wood rests, and the mandril and head being caused to revolve through a portion or the whole of a circle, the bending

is accomplished; the two ends of the curved piece are then connected together, until the fibre of the wood hardens, as in the former case. Mr. Merrick stated that the two objections which had been urged against this plan were, 1st, that the pieces would not retain their shape; 2d, that the strength of the fibre was destroyed by compression so far as regarded a resistance to subsequent extension. That as to the first of these objections, he had seen knees and other curved pieces which had been for some months exposed to the weather, without apparent alteration; and that in regard to the second, time and proper experience were the only tests. He concluded by stating his conviction that the ship-timber bending machine was likely to produce an important effect on ship-building and cabinet-making, so soon as the Company should fully complete their arrangements.

Mr. Merrick also made some remarks upon the late accident to the roof of the new Retort Houses of the Manhattan Gas Company, in New York. This roof consisted of three frames abutting on lines of heavy cast iron gutters, resting upon cast columns; while in process of erection, some weeks since, one of these gutters broke through the caps of the supporting columns, causing its fall, and involving that of the whole roof. From accurate drawings taken upon the spot after the accident, and an examination of the work, it had been found that the gutters, instead of resting in the *whole* of each column cap, as designed, had, by some oversight, been made to bear only on the projecting part of the flanches, which, not being designed for so heavy a strain, gave way when the roofs were but partially slated, involving some loss of life, and great destruction of property. One frame which had not been slated, fell to the ground without injury, while the other two, one of which had been entirely slated, and the other, about three-fourths, suffered severely.

From the designs of the roofs, abundant strength was manifested, but owing to the fact that all the frames were tied together, no part could give way without endangering the safety of the whole.

Dr. Turnbull exhibited to the meeting, specimens of the Natural Printing Process (Naturselbstdruck,) invented by Louis Auer, of the Imperial Printing Office at Vienna. The examples shown consisted of impressions from leaves of trees, several plants, mosses, algæ, lace, and embroideries.

These were all printed in the natural colors of the objects they represented, and were executed in the most delicate and beautiful manner. By many of the members, they were thought to be the objects themselves dried and pasted on the paper. The character of the process was explained by Dr. Turnbull from information obtained from the work of Louis Auer, brought to this country by his learned friend Professor Robley Dunglison, who considers that the process will be of great utility in the studies of the blind.

Query—How can, in a few seconds, and almost without cost, a plate for printing be obtained from an original, bearing a striking resemblance to it in every particular, without the aid of an engraver, designer, &c.?

Solution—If the original be a plant, a flower, or an insect, a texture, or, in short, any lifeless object whatever, it is passed between a copper plate and a lead plate, through two rollers that are closely screwed together. The original, by means of the pressure, leaves its image impressed with all its peculiar delicacies—with its whole surface, as it were—

on the lead plate. If the colors are applied to this stamped lead plate, as in printing a copper-plate, a copy in the most varying colors, bearing a striking resemblance to the original, is obtained by means of *one single* impression of each plate. If a great number of copies are required, which the lead form, on account of its softness, is not capable of furnishing, it is stereotyped, in case of being printed at a typographical press, or galvanized, in case of being worked at a copper-plate press, as many times as necessary, and the impressions are taken from the stereotyped or galvanized plate instead of from the lead plate. When a copy of a unique object, which cannot be subjected to pressure, is to be made, the original must be covered with dissolved gutta percha, which form of gutta percha, when removed from the original, is covered with a solution of silver to render it available for a matrix for galvanic multiplication.

This process is also applicable to the purpose of obtaining impressions of fossils or of the structure of an agate or other stone. In all the varieties of agate, the various layers have different degrees of hardness; therefore, if we take a section of an agate, and expose it to the action of fluoric acid, some parts are corroded, and others not. If ink is at once applied, very beautiful impressions can be at once obtained; but for printing any number, electrotype copies are obtained. These will have precisely the character of an etched plate, and are printed from in the ordinary manner. The silicious portions of fossil and the stone in which they are embedded, may in like manner be acted upon by acid; and from these either stereotyped or electrotyped copies are obtained for printing from.

We trust that some of our botanists will take advantage of this important discovery, and prepare a series of botanical specimens for publication, so that the public may be in possession of examples of this beautiful process. It is rather singular that the workers in German silver and Britannia metal at Birmingham, have, for some time, been in the habit of ornamenting the surfaces of these metals, by placing a piece of lace between two plates and passing these between rollers, but no attempts were made to print from these.

BIBLIOGRAPHICAL NOTICES.

The Principles of Animal and Vegetable Physiology, &c. By J. STEVENSON BUSHMAN, with 102 illustrations on wood. Philadelphia: Blanchard & Lea, 1854. 12 mo. pp. 234.

Principles of Comparative Physiology. By W. B. CARPENTER, with 309 wood engravings. A new American, from the Fourth and Revised London Edition. Philadelphia: Blanchard & Lea, 1854. 8 vo. pp. 752.

We are glad to see the subject of Physiology attracting so much attention from our reading public, as to justify the issue of the number of works on this subject with which the press teems. Of the precise merits of the works before us, it would be unbecoming for us to speak, as the matter lies somewhat beyond the province of our Journal; but we may say, that the work of Dr. Carpenter has been long known and appreciated for its beautiful descriptions and illustrations, and its popularity is testified to by the number of editions which it has gone through in a comparatively few years. In the volume before us, it is presented to us in a handsome and convenient form, well printed and fully illustrated, and cannot be too highly recommended to every one, who has leisure to read it. The other work is a smaller digest on the same subject, which, from the similarity of the cuts, we take to be practically a digest of the larger work, and may be recommended as an introduction to those who have not time or patience for the larger treatise.

JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS.

NOVEMBER, 1854.

CIVIL ENGINEERING.

For the Journal of the Franklin Institute.

Rough Notes of an Exploration for an Inter-oceanic Canal Route by way of the Rivers Atrato and San Juan, in New Granada, South America. By John C. Trautwine, Civ. Eng., Philad.

Continued from page 226.

The River San Juan. I made the length of this river, from San Pablo to the Pacific at Chirambirá, 123 miles.

From the Surúcco to the San Augustín, its average width is about 200 yards. At a few points, however, it is contracted to within half that limit, as at about a league below the Tamaná. Below the San Augustín, both the widths and the depths are, by degrees, considerably increased, the former being frequently 300 yards.

Having found Colonel Acosta's map of the Atrato quite accurate, even in the position of the most important bends, I somewhat too hastily assumed that his delineation of the San Juan was equally so. But as we approached the ocean, the discrepancies between the distances taken from his map, and those reduced from our own observations by time and rate of motion, convinced me that he was in error; more especially as I found also, that his map did not exhibit some important bends which I had noted. Consequently, at the mouth of the Munguidó, or 38 miles above Chirambirá, I commenced taking the courses also; and my protraction of this portion shows that the want of coincidence between his map of the San Juan and mine, as regards the length of that river, is satisfactorily accounted for by his inattention to the details of its sinuosities.

We generally found the current to be about three miles an hour, until some distance below Noanamá, where it gradually diminishes.

There are several islands in the river. The longest is that extending from the San Augustín to the Todó, a distance of a league. They are all low and flat. Like the Atrato, the San Juan is bordered by natural levees, backed by swamps. In the upper portions these levees consist generally of firm materials, such as the gold-bearing diluvium covered with loam, but frequently interrupted by banks of mud, containing beds of leaves, and branches of trees. Below Noanamá we saw no more of this auriferous deposit, except in occasional bluffs.

As we descend, the levees gradually become lower, and consist of softer materials, until at last they merge into soft swamp mud, overflowed at high tide by the Pacific.

Generally speaking, trees fit for fuel are rare along the banks. Bamboos and several varieties of palms occur throughout. We observed no grammalote grass above the San Augustin; but below that stream it gradually becomes quite abundant.

The map does not exhibit all the low hills we saw, some (especially between the Cucuruppí and Munguidó,) having been accidentally omitted. In some few instances, these, instead of an unbroken range, consist of lines of isolated cones. All were covered with trees and shrubs, except where slides had taken place. In such cases the only materials distinguishable were the gray rock, so often alluded to, in various stages of induration; and gravel, and clay. None of the hills appeared to exceed about 300 feet in height; and generally, were below that limit.

Having thus briefly referred to the general characters of the San Juan, we will proceed to notice a few of its details.

We did not ascend the river above San Pablo, but were told that its navigation became much more impeded by rapids and shoals; a fact which, however, was quite inferable from the contiguity of the mountains in which it has its rise. We commenced our descent of the river in August 27, at half past 10 A. M. The velocity, even at its present low stage, is at least as great as that of the Atrato above Quibdó, when in high flood; and we paddled off at the rate of about four and a half miles per hour with ease.

I have stated that at both visits to San Pablo, we happened to find the river at the same stage, viz. five feet deep for nearly its entire width of 450 feet; and that its ordinary stages here fluctuate between five, and seven or eight feet.

But while the depth was five feet at San Pablo, we found a few places within four miles below the town, that gave but four feet as the greatest depth for a very narrow part of the channel; the greater portion of the cross-section at those points affording but three, or three and a half feet. In such places the river can scarcely have sufficient depth for the larger canoes or ranchadas of the country, in its lowest stages.

At a few hundred yards below the town is a bad shoal of large rounded pebbles, which (when there is five feet channel at the town) has but eighteen inches of water, with the exception of a width of about seventy feet on one side; where the water impinging strongly against a rocky hill bank on the concave side of a considerable bend, has worn for itself a channel of from twelve to sixteen feet in depth. In ascending the rapid at this spot, our men could not pretend to stem the current in the deep

part, and had to get into the water in order to force our ranchada up even the shoal portion.

We found this rock to be an excessively hard and tough tertiary sandstone, containing pebbles. We saw in it a few very thin seams of black bituminous matter, resembling some bituminous coal, or compact lignite. The strike of its strata was about N N W. and S S E., with a nearly vertical dip. We observed no fragments of shells in it. This rock shows itself at different points for a few miles below San Pablo, and supports the auriferous diluvium. Its strike and dip both appeared to vary in different places, as well as we could judge from the small portions exposed.

About a mile below the town occurs another shoal, over which the river runs very rapidly. To the eye, the fall here appears to be about three feet in 100 yards.

A little below this shoal, we found six feet of water nearly all the way across ; but at half a mile below that again, there were but from three to four feet ; or less than at the town.

Between San Pablo and the Surúcco, the San Juan appears to be a succession of dams and pools. In this distance of some seven or eight miles, there occur five bad shoals and rapids. But below the Surúcco, there are none of any importance, except a rapid about half a league below the Mico. This, however, is less formidable than the others.

At ten miles below San Pablo, in a straight reach, where the river was nearly 600 feet wide, we found a depth of six feet for a width of 100 yards. This becomes reduced to about three feet in the lowest stages.

At this place, as well as at others, both above and below it, we plainly heard a low tinkling sound, which at first, we thought was produced by a few large shower drops falling on the dry leaves of our toldo cover. Our men, however, said it was to be heard at all times, being caused by the rolling of the pebbles on the bottom of the river ; and, by placing our ears near the water, we heard it much more plainly. It is difficult, however, to reconcile the rolling of large pebbles, and a surface velocity in the river of but three miles an hour ; and I certainly have never known the same effect to be produced in any other stream. A little above Noanamá, the sound was quite distinctly, and uninterruptedly audible, where the depth was nine feet.

From the Tamaná, (or about four leagues below San Pablo,) down to the ocean, we felt at times a brisk, refreshing breeze setting up the river, which we were told was the sea breeze.

This branch of the San Juan appeared to be about seventy-five yards wide at its mouth. The broad marsh tracts which border it, afford views of the mountains of Nóvita, from the San Juan.

For several leagues below the Tamaná the river has many bars, which were bare when we desended, and which at a somewhat higher stage of water, would require a skilful pilot. We also noticed many large sunken trees which would embarrass the navigation in low stages.

Having descended the river about nine leagues below San Pablo, we stopped a little before sunset, at a negro hut a mile above the Dipurdú. Here we bought some chickens for supper, but our men could procure

nothing to eat with them. The Doctor and I had our biscuit and claret; but our peones had declined laying in a supply of plantains at San Pablo, on account of their exorbitant price of a dollar and a quarter per ration of sixty-four. This fruit is the principal article of food of the lower classes, and I really pitied our poor fellows, who had expected to be able to procure them at any hut along the river. We had not eaten during the day, having postponed doing so from time to time, in hopes that at the next hut we should be more fortunate.

Arrangements with peones should always require them to find themselves in provisions. Otherwise they are continually discontented; and moreover, are apt to eat so much as to incapacitate them for hard work. I have, on previous occasions, before the adoption of this rule, had three or four naked peones rolling themselves in the sand in agonies of colic induced by stuffing, rubbing their stomachs, and crying out in piteous tones, "mi madre, mi madre" (my mother, my mother). At first I relieved them by doses of brandy; but as this course increased the number of attacks to an alarming extent, I abandoned it, and made them instead, an allowance in money sufficient for abundant supplies. After this I had no more cases of colic among my men.

While supping, we had trouble to keep the roaches, and the noses of a dozen half starved dogs out of our plates. Some six or eight naked negroes stood by, anxiously watching every mouthful, with expressions of astonishment that we did not hurt ourselves with our knives and forks: for in this section of country, the adage, "fingers were made before forks," still applies in full force, except among a few families in the large towns.

During the afternoon we had two or three smart showers; but at dusk it began to rain hard, and so continued until midnight. The river however, fell nearly a foot.

The next morning we started at sunrise, a thin mist hanging over the river, and adjacent marshes. The current was still full three miles per hour, so that with but one peone paddling at a time, and that very lazily, we made four and a half miles.

At a mile below our starting place, we passed the mouth of the Dipurdú, which here appeared to be a mere creek, some fifty feet wide, and full of old logs. At its head is an atravesia communicating with the Sandó, a branch of the Pepé.

A mile below the Dipurdú, in a straight reach of uniform cross-section, and where the width of the San Juan was at about its average of 200 yards, we found a mid-channel depth of nine feet for full half the width. Judging from the line of no vegetation along the sides of the levees, I consider this as what may be called a *low ordinary* stage, but which is doubtless frequently reduced to some six feet.

At about nine miles, (or thirty-six miles below San Pablo,) we passed the river Sipí, or San Augustín, the largest tributary of the San Juan.

About 12 miles below the San Augustín, or 48 miles below San Pablo, we passed the village of Noanamá, opposite which I stopped the ranchada for a few minutes in order to make the sketch Plate v.

Here the San Juan is about 250 yards wide; and the current was full three miles per hour, notwithstanding the moderate stage of the river.

Owing to the accession of the waters of the San Augustín, we here

found the depth on the convex side of a bend at Noanamá to be thirteen feet for half the width of the stream, thence gradually increasing to 27 feet near the concave side.

Part of the banks for several leagues above, as well as close to the town, consisted of the indurated tertiary grey clay, with small fragments of shells. At Noanamá the strike of its strata was N E., with a dip of some 15 or 20 degrees to the S E. In other places we found different dips to this same formation, ranging from horizontal to vertical; but the strike generally appeared to be N. Eastwardly.

As we paddled past Noanamá, our poor peones hailed every one they saw on the banks, (as they had done all the way down,) to inquire for plantains, or anything else that a poor half starved mortal could eat. But nothing was to be had.

About sunset we again stopped for the day at a miserable negro hut, some 13 miles below Noanamá, or 61 miles below San Pablo. Unfortunately for our hungry peones, the destitution of comestibles was here greater than at any of the numerous huts at which we had unsuccessfully applied during the day.

In vain did I suggest to the patron, the expediency of resorting to a neat little "ruse," which I had before known to be eminently successful in similar emergencies, viz: to walk around the premises, and by the most singular accident conceivable, to cut off the heads of two or three chickens by a single stroke of a machete aimed at an imaginary snake rustling in the adjacent bushes. He assured me, with a doleful face, that a most thorough reconnoissance had failed in detecting a single chicken track near the house.

I then appealed to his best sympathies by uttering the single word, "platanos," (plantains.) He replied by the single word, "tampoco," (neither.)

To my "nada?" (nothing?) he despondingly sighed, "nada!"

Finally, I suggested the pleas of hospitality, religion, the Governor's letter, and, last of all, the respect due to the patron's own official position as a Judge, or Justice of the Peace, (which he actually held.) The Judge stood up to the suggestion like a man, and poured in a volley of hospitality, religion, letters, and respect for the laws, that might have melted the heart of a stone. But our hostess did not happen to be a stone; but merely the stump of a segar, attached to something resembling the outlines of a mummyfied orang outang. While the Judge feelingly quoted the injunction to "feed the hungry," and expiated upon the fine opportunity that now presented itself, for a practical application thereof, the segar complacently persisted in evolving the most contemptuous volumes of smoke imaginable; while the aperture in which it was inserted, automatically marked the termination of each tender appeal, by a grunt of "no hay nada," (there is nothing.)

And, in fact, there was nothing; so the Doctor and myself were compelled to provide for the whole party from our own scanty supplies.

The only rain that fell to-day was a few drops early in the morning, and a thunder shower of half an hour's duration in the evening. The river fell two feet in the course of the night.

Next morning we gladly left this inhospitable spot an hour before sun-

rise, and proceeded on our way, hailing every hut we passed in hopes of finding provisions. On these occasions, the colloquy between the patron and the people on the banks, was usually in this style:

	Spanish.	English.
Patron.	Adios Amigos.	How do you do, friends?
Dogs.	Bow, wow, wow.	The same.
Hut.	Adios señores.	How do you do, gentlemen.
Patron.	Hay platanos?	Have you plantains?
Hut.	No hay.	We have none.
Patron.	Una gallina?	A hen?
Hut.	Tampoco.	Neither.
Patron.	Huevos?	Eggs?
Hut.	Tampoco.	Neither.
Patron.	Caña?	Sugar-cane?
Hut.	Tampoco.	Neither.
Patron.	No hay nada?	Have you nothing?
Hut.	Nada absolutamente.	Absolutely nothing.
Patron.	Valga me Dios. Adios Amigos.	God help me. Good bye, friends.
Hut.	Adios Señores. Que vayan, ustedes con felicidad.	Good bye, gentlemen; may you go with happiness.
Dogs.	Bow, wow, wow.	

Fortune, however, smiled on us at last, and at an Indian rancho we purchased chickens, eggs, and plantains, sufficient for all hands; beside shooting a wild turkey. At another Indian hut, about 24 miles below Noanamá, we stopped to cook our breakfasts. The proprietor was a grave, and very respectable looking old man, somewhat sleek and rotund; and altogether decidedly civilized and aldermanic in his general appearance, which presented a striking contrast with the usual semi-barbarous aspect of his countrymen. He had been indulging rather too freely in guarápo the night before; and was still asleep when we entered, although it was 10 o'clock. Unaldermanlike, however, he was on top of a table, instead of under it.

A handsome silver-headed cane reposed by his side; and about a dozen massive silver rings graced each ear. From this, I inferred that he was a kind of chief, or *ring-leader* of a tribe. At last he awoke, and sat up on the table in a state of semi-consciousness, while his wife washed his face, and swabbed him down with a rag.

Revived by this operation, he began to look stupidly around him; and I at once apologized for having ventured to intrude upon his domains without permission. He smiled good naturedly, and merely replied in a bland tone " the old man is your servant."

We generally found the Indians to be taciturn, as regards putting questions to us, although they invariably replied to ours with entire readiness, and in a kind friendly tone. They also appeared to be as devoid of curiosity as our own Indians; and never annoyed us in the least degree by intrusiveness of any kind.

They speak both Spanish, and their own peculiar idioms; but the Negroes speak Spanish only.

At, and below Noanamá we passed many painted, and a few tattooed Indians. Some of the latter were perfectly diabolical looking objects; and our sense of propriety was at times severely tested in refraining from laughter at their comico-lugubrious phizes.

Along here, the sand-fly gnats began to be troublesome on shore, which is becoming lower and more entirely swampy, except where broken by hills.

The rivers Cucuruppí and Copóma, which we passed to-day, appeared to be each about 100 feet wide at their mouths. The Guapágara seemed to be but a small creek; as did also the Decordó,* the Jusia.ó, and the Panamá. The Munguidó has a width of perhaps 200 feet at its mouth, and looked like a fine stream. At half a league below the Munguidó, commences an island half a league in length; which, by a slight oversight, is incorrectly shown on the map. At its lower end we found a negro rancho, at which we stopped at sunset, having descended the river about 90 miles below San Pablo, or 42 miles below Noanamá.

Miscalculating the length of our trip from Acosta's map, we had expected to reach the Pacific to-night; but we were here told that a full day's voyage yet remained to be performed.

At this point we found the current to be about $2\frac{1}{3}$ miles per hour. The island was some 6 or 7 feet above the surface of the river; but our host, who has lived on it for a quarter of a century, told us that the San Juan sometimes rises here as much as 10 feet above the stage in which we saw it, submerging the island, the levees, and a very wide tract of back country on both sides.

We noticed many bats flying about the house, and clinging to its ceiling; and were much annoyed by gnats.

There was rain for about an hour in the middle of the night.

When we started next morning, our host accompanied us. We were pretty certain that we should not reach the ocean until after dark; and as the river has several mouths, and our peones had never been here before, there was a reasonable chance of losing our way, unless provided with a guide. I therefore proposed to the master of the house, that he should go with us in that capacity; and he good naturedly consented.

A set of soundings taken about four miles above the confluence of the Calíma, at a place where the width of the San Juan was some three hundred yards, gave but three feet of water, extending from one bank to near the centre of the stream. The other half of the width, however, varied from 20 feet deep near the sides, to 45 feet in the centre. Our new pilot told us that the river did not fall sufficiently low to expose the shallow portion of the bed, more than three or four times a year. The clay and mud levees about here, were generally from three to five feet above the ordinary stage of water as we now saw it.

The River Calíma enters the San Juan about nine leagues above Chirambirá.

When we returned from the Ocean, we ascended it several miles on our way to Buéna Ventúra, and I will refer to it more fully in the proper place.

At four leagues below the Calíma, or five leagues above Chirambirá, we reached the point at which the San Juan bifurcates into the two chan-

* The terminating "do," means river, in the Indian dialect. Quibdó, is the river of gravel; Murindó, the river of mud; Munguidó, the river of mosquitoes, &c., as given to me by Lieutenant Porras of Quibdó.

nels which constitute the northern and southern boundaries of the delta at its mouths.

The principal volume of water flows through the southern branch, which still retains the name of San Juan. Its width appeared to be about the same as for some miles above the point of divergence, namely, near 300 yards; with a mid-channel depth of between six and seven fathoms. This branch, however, is not used, on account of the formidable obstructions of bars at its mouth.

The northern branch is called the Caño Chirambirá; and has, at its junction with the southern one, a width of but 150 yards; with a mid-channel depth of three fathoms.

Before reaching the Ocean, this caño separates into other branches, which discharge into the Pacific, through their respective mouths, as shown on the Map. Plate VIII.

At about two leagues from the Ocean, Caño Estevaníco diverges to the south; and at one league, Caño Chogoromá passes off to the north. At the last point, Caño Chirambirá has gradually attained a width of some 200 yards; but its channel-depth has diminished to ten feet at ordinary low tide of the Pacific. At half a league from the sea, Caño Chirambirá turns to the southward, and enters (in a distance of a few hundred yards) the head of the insignificant bay of the same name; while Caño Churimál, forms the straight continuation of the principal body of the water. See Map, Plate VIII.

This branch widens rapidly as it approaches the sea.

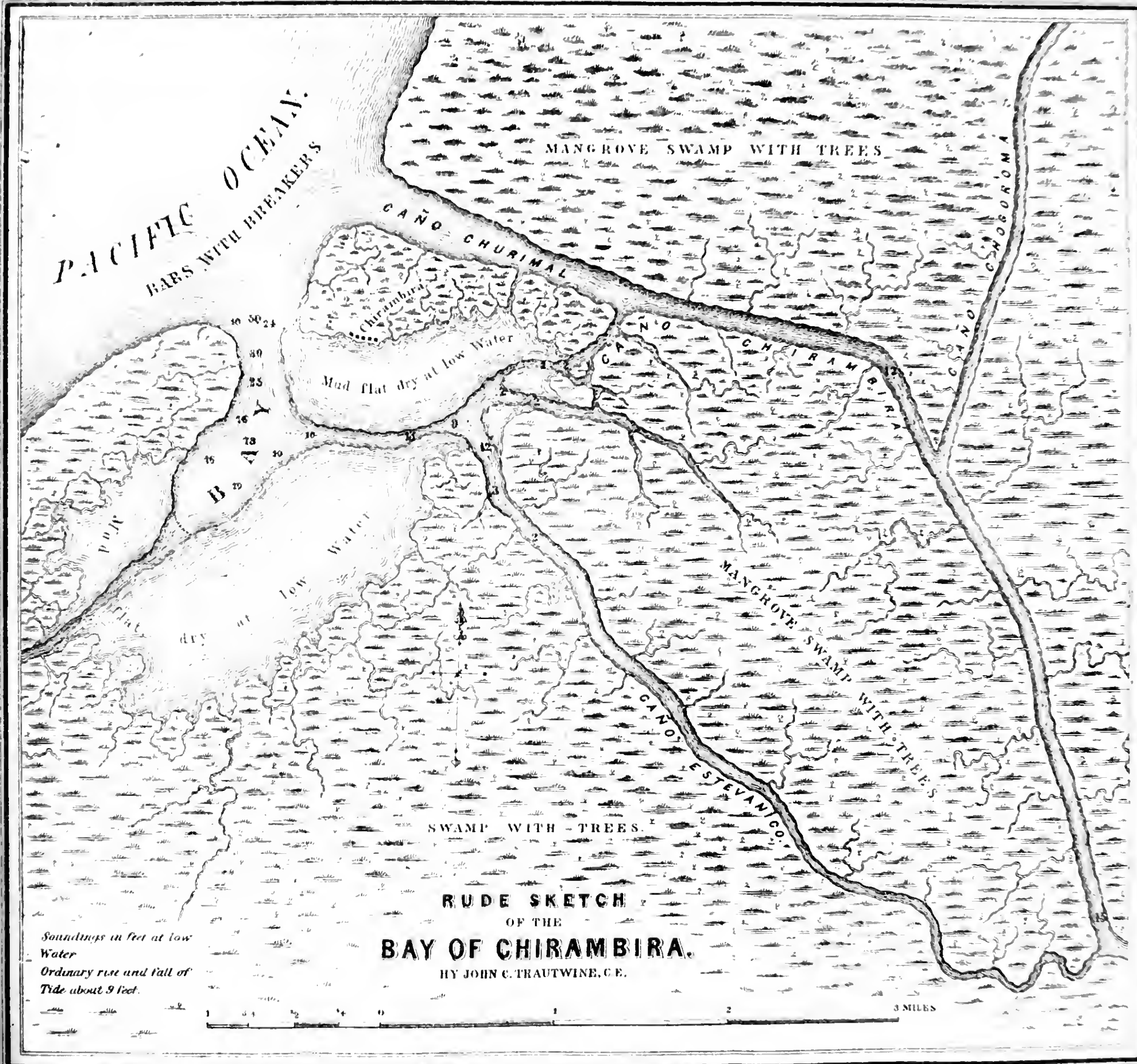
Both Caño Chirambirá and Caño Estevaníco, are nearly dry at low water, near their respective entrances into the bay.

It is, indeed, only by a stretch of geographical courtesy, that this sheet of water can be called a bay. At extreme low water, more than three-fourths of its area are dry. It is, moreover, rapidly filling up with mud brought into it by Caños Chirambirá and Estevaníco; as well as that from the circumjacent mangrove swamps. Señor Carcáche, the proprietor of Chirambirá, has resided in this purgatory for twenty-two years; and he informed me that he has seen large ships float at anchor at low water, in portions where they would now ground at the highest tides. At that time there existed, according to his statement, an ample depth of water over the bar, for the entrance of merchant ships; while the bay itself, constituted a safe and capacious harbor of refuge, to which vessels frequently resorted in stress of weather. He assured us, moreover, that a good entrance channel, with some four or five fathoms of water, still remains. Of this, however, we perceived no indication from any point to which we could venture out in our boat, after having taken the precaution to convert her into a "bolsa," by lashing stout poles to her sides, to prevent upsetting.

On the contrary, the whole coast, as far as we could see, for several miles above and below the bay, appeared to be defended by continuous parallel lines of bars and breakers.

The sketch (Plate VIII,) which I have given of the bay, is an extremely rude one, based merely upon rough estimates of distances by eye, aided by compass bearings, taken from a canoe as it was being paddled around close to the shore at high water. The soundings were made near the


PACIFI
BAR
Flat
Soundings in feet at
Water.
Ordinary rise and fa
Tide about 9 feet.


PACIFIC OCEAN.
BARS WITH BREAKERS
MANGROVE SWAMP WITH TREES
CAÑO CHURIMAL
Chirambira
Mud flat dry at low Water
CAÑO CHIRAMBIRA
CAÑO CHOGOROMA
BAY
flat dry at low Water
MANGROVE SWAMP WITH TREES
CAÑO ESTEVANICO.
SWAMP WITH TREES.
RUDE SKETCH
OF THE
BAY OF CHIRAMBIRA.
BY JOHN C. TRAUTWINE, C.E.
Soundings in feet at low Water
Ordinary rise and fall of Tide about 9 feet.
3 MILES

time of *ordinary* low water, and are tolerably approximate for that stage. A reference to the sketch will show that a small part of the bay has a sufficient depth to render it available as a harbor of refuge, in case there should really be an entrance to it across the outer bar. On this point I am not prepared to give a definite opinion; for, on the one hand, I am unwilling to assume that Señor Carcáche's long residence at Chirambirá had rendered him indifferent to the doctrine of future punishment; while, on the other, I could see no interruption in the long lines of outside breakers sufficient to warrant the suspicion that he was correct. We did our best to determine the point by actual sounding; but were driven back by the roughness of the sea. We could procure no vessel larger than our small ranchada; and, in view of the hopelessness of an inter-oceanic canal, as established by my examinations in the San Pablo region, I did not consider it worth while either to incur any serious risk, or to remain at Chirambirá for a perfectly calm day.

Chirambirá consists only of the dwelling of Señor Carcáche, and a few wretched out-huts, without sides, for his dependants; (see Plate VII.) It occupies a short narrow strip of low sand beach, the only habitable spot around the bay. All the adjacent country is mangrove swamp, overflowed by high tides. Indeed, the buildings themselves are occasionally insulated by extreme high water; so that it would be difficult to imagine a more ineligible spot for a habitation.

Had it not been for the precaution of taking a pilot, we should certainly have dropped down Caño Churimál, and gone to sea; for the night was perfectly dark for some time before we reached the point at which Caño Chirambirá diverges at right angles from the larger Churimál branch; and as the rain was at the same time pouring in torrents, we could not see the proper course. Our pilot, however, found it by some instinctive faculty; and very soon the tossing of our boat proved that we were near the ocean. After half an hour's uncomfortable expectation of being upset in the dark, we at last landed at the only spot where landing was possible, in front of the huts. All the occupants had retired for the night; but our pilot "knew the ropes," and guided us to the largest one. Of a portion of this we took possession, and were soon asleep on the hard floor, supperless, and unmindful of the trickling streams that fell on us from the holes in the roof.

Our observations at Chirambirá, which are embodied in the Map, Plate VIII, occupied us for two days; and early on the morning of Thursday, September 2d, we left it for Buéna Ventúra, via the San Juan and the Calíma.

I had remained well during the entire trip, until, singularly enough, while in the act of drawing in my lead line, after taking the last sounding in the bay, I was attacked by a severe chill. The reflection, however, that I had fully accomplished the object of my mission, served to alleviate what would otherwise have proved a very harassing incident; and, as I stretched myself out on the palm strip floor, during the subsequent paroxysm of fever, it was with the independent feelings of one who could now afford to be sick.

It rained every day and night while we were at Chirambirá; not continuously, but in a succession of hard showers during the day, and pretty

steadily throughout the night. As we ascended the San Juan on our return, I had an opportunity of supplying some compass-bearings and distances, which the darkness of the night had prevented me from obtaining as we descended.

Traveling against the current, we gained but 20 miles the first day, although we kept on until after dark. We should have done better had we not stopped for half an hour to enable our pilot to pay a flying visit to a friend living on the bank. Two of our peones accepted a pressing invitation to accompany him; the consequence was, that they all imbibed so much guarápo as to prevent the pilot from returning at all; while the peones, for the remainder of the day, were continually "catching crabs" with their paddles; and turning summersets, sometimes into the boat, and sometimes into the water, from which we had to fish them out.

The hut at which we passed the night, consisted of but one room; and was occupied by five families. They did not, however, lie about the floor promiscuously; but each family, on retiring, spread for itself a separate *tent*, each about five feet long, and three and a half feet high. Delicacy forbade my lifting the side of a tent, to see how they packed themselves away, but from their numbers it must have been much in the cozy style of boxed herring.

It rained heavily during the night until daybreak.

At 9 o'clock next morning, we reached the mouth of the Calíma, and commenced the ascent of that stream.

I had been quite unwell all the preceding day, and still continued so. It was only by extremely unpleasant exertion that I could continue, and note down the few very superficial observations that I made respecting the Calíma, and the remainder of our route to Buéna Ventúra.

This branch of the San Juan enters the latter at about 9 leagues from the Pacific. Its width at its mouth is above 200 feet; and this width it preserves for four or five miles, with a mid-channel depth of full 12 feet at ordinary stages. At 10 or 12 miles from its mouth, it has an ordinary mid-channel depth of 10 feet; and a width generally varying from 125 to 175 feet. Its levee-banks, as far as we ascended it, were clay and mud, containing beds of old leaves and branches of trees. Back of them the ground was swampy. Gravel shows itself in a bluff near the mouth, and also some ten miles above it; and throughout, low bluffs from 15 to 20 feet high occur. We saw no nearer approximation to rock than the indurated gray clay occasionally.

At 5 o'clock P. M., we stopped for the day, nearly 6 leagues from the San Juan. From here upwards, gravel becomes more abundant, both in the bed of the stream and in the banks. No rain to-day or to-night!!

At about seven leagues from the San Juan, we left the main Calíma and entered one of its branches, called the Guinéo. Up to this point the Calíma was rarely under 40 yards wide.

We followed the Guinéo but about a mile, and then entered a branch coming from the S W. This latter is a trifling stream, averaging from 6 to 8 yards wide: very serpentine, and with but from one to two feet of water when we ascended it. Its very bed is generally between five and eight feet below the tops of the banks; and is full of old fallen trees, and logs. The banks themselves consist of clay, mud and layers of old

leaves. At a few spots we saw the indurated gray clay, disposed in nearly horizontal strata, and occasionally containing so much coarse sand and gravel, as to constitute a species of soft sandstone. This little branch we ascended for some eight miles to the place of debarkation.

Here we left our boat, and walked across a pathway about one and a half miles long, to the stream which was again to carry us to the Pacific, at Buéna Ventúra.

Before leaving Chirambirá, I had communicated to the patron and peones, my intention not to return to San Pablo and Quibdó; but had secured their services to accompany us across the atravesía, at which we had now arrived. Here they strapped to their foreheads the little baggage which Doctor Halsted and myself had brought with us, and started off for the Puérto de Guinéo, half a league distant.

At my request, the Doctor accompanied them, in order, if possible, to secure either a canoe for proceeding at once to Buéna Ventúra; or a place in which to lodge for the night. Being myself excessively weak from fever, I did not wish to impede our progress. The walk of a mile and a half occupied me two full hours. The pathway is across an elevation which I judged to be less than 100 feet above the stream we had just left; and still less above that to which we were going. The soil is clay, resting on the indurated tertiary gray clay. I saw no fragments of shells in the latter, at this place.

When I reached the other end of the atravesía, I found that in consequence of the approach of rain, Dr. Halsted had not been able to induce the boatmen of the Puerto to take us to Buéna Ventúra, (distant 4 hours,) that evening; but he had secured a very good lodging place in one of the half dozen huts which constitute Puerto de Guinéo.

Next morning at 6 o'clock, we bade farewell to our faithful patron Rociles, and his peones; and entering a canoe we reached Buéna Ventúra at 10 A. M.

This is a mean hole, about as large as Quibdó, consisting chiefly of one main street, and containing about a hundred huts, and tumble-down frame houses, many of them two stories high. It stands on one side of the little bay of the same name, between which and it there is no parallel thoroughfare; but, at low water, a wide mud-flat. The town itself stands on dry land; and there is a slight hill of the gold-bearing diluvium in its rear. All else is marsh. The visiter who ascends the hill, will be rewarded by a birds'-eye view of the town, and the bites of a thousand yávis, or minute seed ticks.

After a delay of five days, we took passage in a little coaster, (a cross between a tub and a sieve,) for Panama, where we arrived safely in a few days.

NOTE.—Owing to the inexcusable negligence of the person intrusted with the preparation of the Map, Plate XII, Volume XXVII, the coloring of my line of routes was omitted.

*On Compound or Trussed Cast Iron Beams or Girders.** By W. Fairbairn, C. E., F. R. S., &c., &c.†

(Continued from page 229.)

This result is consistent with that of Table I., where the elongation of cast iron, for equal increments of force, is shown to be $2\frac{1}{4}$ times that of wrought iron. The elongations in this table may be approximately derived from Table I.

Further, with a force of about $5\frac{1}{2}$ tons applied to cast iron, and $12\frac{1}{2}$ tons to wrought iron, the sets, as well as the elongations, are nearly equal to each other. Now, if these forces had been duly apportioned to each other, this circumstance would have given us an eligible principle for adjusting the tension of the iron rods in a truss beam ; but, unfortunately, this strain upon the cast iron is too near the strain requisite for producing rupture, while that upon the wrought iron is only about one-half its greatest tensile resistance. For forces below $5\frac{1}{2}$ and $12\frac{1}{2}$ tons, the set of the cast iron is greater than that of the wrought iron ; and for forces above $5\frac{1}{2}$ and $12\frac{1}{2}$ tons, the reverse takes place.

Table IV.—*Ultimate elongations, the cast iron being loaded with $7\frac{1}{2}$ tons per square inch, and wrought iron with 24 tons per square inch.*

Name of the Metal.	Total ultimate elongation, in parts, of the length of the bar.	Ultimate elongation per ton, in parts, of the length of the bar.
Cast iron, . .	$\frac{1}{550}$ or ·22 in. on 10 feet.	$\frac{1}{4000}$
Wrought iron, .	$\frac{1}{21}$ or 5·7 in. "	$\frac{1}{520}$

Hence it follows that the ultimate elongation of wrought iron per ton on each square inch is about eight times that of cast iron, and that the total ultimate elongation of wrought iron is about 26 times that of cast iron.

If we take the results of Mr. Loyd's experiments,‡ where the average of the breaking weights was 32 tons per square inch, we shall find that the total ultimate elongation of wrought iron is about 130 times that of cast iron.

Table V.—*Permanent set of bars, expressed in parts of their elongation.*

Weights in tons per square inch.	Cast iron. Set in parts of the elongation.	Wrought iron. Set in parts of the elongation.
2	1-13	Scarcely per-
3	1-11	ceptible.
5	1-9	1-110
7	1-7	1-112
10		1-60
15		$\frac{1}{2}$
20		11-12

* "*On the Application of Cast and Wrought Iron to Building Purposes.*" By W. Fairbairn, C. E., F. R. S., &c., &c. London: J. Weale. 1854.

† From the London Artizan, June, 1854.

‡ See the Author's *Experimental Inquiry into the Strength of Wrought Iron Plates, &c.*, published in the Transactions of the Royal Society for 1850.

Here it will be seen that for weights below $7\frac{1}{2}$ tons, the set of cast iron is incomparably greater than that of wrought iron; on the contrary, for weights above 15 tons, the set of wrought iron is considerably greater than the maximum set of cast iron.

TABLE VI.—*Mean elongation of cast iron and wrought iron bars* 10 *feet long, by an increase of* 90° *temperature.*

Length of bar 10 feet.	Elongation due to 90° increase of heat.	Difference of the elongations on 10 feet.
Cast iron, . .	·0666 inches.	·0067 inches.
Wrought iron, .	·0733 "	

Comparing the results of this table with those of Table I, we find that the elongation of wrought iron by an increase of 90° temperature is equivalent to the action of a tensile force of 7·4 tons per square inch, and that of cast iron to a force of 3 tons per square inch. Moreover, the difference of the elongations of the two metals is equivalent to the action of a tensile force of $\frac{3}{4}$ ton per square inch. It is also worthy of remark, that while making experiments relative to the elongations of metals when acted upon by tensile forces, we should carefully observe that the temperature remains nearly the same.

From a careful induction of the facts contained in these tables, let us endeavor to determine the best adjustment of the tension of the truss rods.

First—Let us consider the case, when the truss rods have no strain upon them at the time the beam is unloaded.

Suppose the beam to be loaded so as to produce a tensile strain upon the cast iron equal to one-third its breaking load, that is to say, let the force of elongation be $2\frac{1}{2}$ tons per square inch upon the cast metal; then, from Table III, we find that the strain upon the truss rods will be about $5\frac{1}{2}$ tons per square inch, and that the set of the cast iron, after these strains are taken off, will be six times that of the wrought iron. Now, in this case, while the cast iron is strained to one-third its breaking weight, the wrought iron is strained to only about one-fifth its ultimate strength; and, further, when the load is taken off, the cast iron beam will remain much more elongated than the iron rods, which will, to a certain extent, destroy their original adjustment of tension; but this, in the present case, will not act unfavorably, for it will tend to give a certain amount of tension to the truss rods.*

Suppose the beam to be loaded so as to produce a tensile strain upon the cast iron equal to $5\frac{1}{2}$ tons per square inch; then, in order to produce an equal elongation of the truss rods, the strain upon them must be $2\frac{1}{4}$ times $5\frac{1}{2}$ tons, or $12\frac{1}{2}$ tons nearly. Here, while the cast iron is strained to more than two-thirds its ultimate resistance, the wrought iron is only strained to about one-half its ultimate resistance. One favorable circumstance connected with this load is, that the sets of the two metals are very nearly the same.

Suppose the beam to be loaded so as to produce a tensile strain of 15 tons per square inch upon the truss rods, then, by Table II, this will pro-

* We have here considered the length of each truss rod to be one-half the length of the beam. This supposition will obviously involve no appreciable amount of error.

duce an elongation of $\frac{1}{440}$th part of the length of the rod ; but by Table IV, the ultimate elongation of cast iron is $\frac{1}{550}$th part of its length ; therefore, the cast iron would be ruptured by extension some time before the truss rods could arrive at a strain of 15 tons per square inch, that is, before they could be strained to two-thirds their ultimate strength.

This adjustment is defective ; the truss rods must obviously have a certain amount of tension before the load is laid on, in order to bring them into a higher condition of action, and to counteract the set of the cast metal.

Second—Suppose the truss rods to be screwed up so as to give them a tension of 8 tons per square inch, or one-third their breaking tension ; and, for the sake of simplicity, let us suppose that the half length of the beam is 10 feet. This high tension of the truss rods, it should be observed, will produce a dangerous action upon the cast metal.

Suppose the beam to be loaded so as to produce a tensile strain of $7\frac{1}{2}$ tons per square inch upon the cast metal. Now, by Table IV, this would give an elongation of ·22 inches ; but the truss had an elongation of ·077 inches due to the strain of 8 tons when the beam was in a neutral condition ; therefore, the total elongation of the truss rod will be ·22+·077, or ·297 inches; but from Table II, we find this elongation to correspond to about 16 tons per square inch tensile force upon the rods. Thus it appears that, even with the dangerous tension of 8 tons per square inch on the truss rods, we cannot produce a higher strain than 16 tons upon them at the moment when the cast iron is about to rupture.

Reasoning in this manner, it may be shown that it is impossible to construct a truss beam which shall task the high tensile resistance of wrought iron without at the same time introducing a dangerous action upon the cast metal. We have shown, in Tables II and IV, that for high proportional tensions, the rate of elongation of wrought iron is from 10 to 26 times that of cast iron ; hence it is impossible to have the two metals acting in concert at tensions approaching their rupture.

Since little is gained by this high tension in point of ultimate strength, and much is lost by the injury done to the beam, we must reduce this tension in order to arrive at the best form of the truss beam.

Third—Let us endeavor to discover the tension which must be given to the truss rods, so that the different parts of the truss beam may be respectively loaded, at the same moment, with one-third their respective ultimate tensile resistances, viz : $2\frac{1}{2}$ tons per square inch for the cast iron, and 8 tons per square inch for the wrought iron.

Here, by the law of Table III, the additional force tending to elongate the iron rods per square inch $= 2\frac{1}{4} + 2\frac{1}{2} = 5\frac{5}{8}$ tons. Putting $t =$ the tension of the rods per square inch at the moment when the cast metal has no strain upon it, we have

$$t + 5\tfrac{5}{8} = 8,$$

$$\therefore t = 2\tfrac{3}{8} \text{ tons per square inch, or } 2\tfrac{1}{2} \text{ tons nearly.}$$

Suppose the beam to be loaded so as to produce a tensile strain of 4 tons per square inch of the cast metal, then the truss rods will undergo an additional strain of $2\frac{1}{4}$ times 4 tons, or 9 tons per sq. in., which, added to $2\frac{1}{2}$ tons, will give $11\frac{1}{2}$ tons for the whole strain per square inch of the truss rods; so that the two materials will be loaded to about one-half their

respective breaking weights ; and, moreover, it may be shown from Table III, that the sets of the two metals after the load is taken off will be nearly the same.

Hence it appears that the most eligible adjustment of the truss rods is to give them a tension of from 2 to 3 tons per square inch.

But a load of $5\frac{1}{2}$ tons per square inch on the cast metal would tend to destroy the adjustment ; for this would produce a strain of about $13\frac{1}{2}$ tons per square inch on the truss rods ; and after the load is taken off, the set of the wrought iron would be about three times that of the cast metal. It may be further observed, that a strain of less than 15 tons per square inch upon the wrought iron would rupture the cast metal.

An ordinary beam (especially when the material is wrought iron) may be safely loaded, to meet contingencies or particular exigencies, within two-thirds of its breaking load ; but this cannot be done with truss beams; for, with the best adjustment of the trusses, as we have shown, the cast metal will be upon the point of rupture before the wrought iron has attained two-thirds its ultimate resistance.

Upon the whole, it appears to be impracticable to attain such an adjustment of the parts of a truss beam as to secure the safety of the beam, with a due regard to the most efficient action of all its parts. The two materials are so different in their physical as well as in their mechanical properties, that it seems impossible to construct a beam with them where they can, under all ordinary strains, act in concert with each other. But even supposing that we are able to construct a truss beam with all its parts perfectly adjusted, how long would it remain so ? Besides the disturbances arising from unequal elongations and sets, sudden collisions, changes of temperature, and other causes, would tend to destroy this adjustment. The defect of a truss beam consists not so much, perhaps, in its want of economy, as regards the distribution of material, as in its want of stability and safety ; within comparatively small limits of load, a truss beam may pass from a condition of perfect security and safety to one of uncertainty and danger.

Approximate Rule for calculating the strength of a Truss Beam.—In order to calculate the strength of trussed beams, let us suppose that the tension of the rods is such as to cause them to have a strain of 8 tons per square inch, at the same moment that the cast iron has a strain of $2\frac{1}{2}$ tons per square inch ; then, with this *perfect adjustment*, we have found, by a process of reasoning which need not be given in this place, the following approximate rule for calculating the weight with which the beam may be safely loaded :—

Add three times the section of the truss rods to the section of the bottom flanch, substitute this sum for the bottom area in the usual formula for calculating the strength of cast iron beams, and one-third this result will give the weight of safety, or one-third the theoretical breaking weight.

Thus, let $w =$ the load of safety, $a =$ the area of the bottom flanch, $a_1 =$ the section of the truss rods, $l =$ the distance between the points of support, and $d =$ the depth of the cast metal beam ; then

$$w = \frac{26\,(a+3\,a_1)\,d}{3\,l} \text{ tons} \quad . \quad . \quad (1).$$

In the first series of experiments, we find $a = 1{\cdot}05$, $a_1 = {\cdot}39$, $d = 4$, $l = 4{\cdot}5 \times 12$,

$$\therefore w = \frac{26\,(1{\cdot}05 + 3 \times {\cdot}39)\,4}{3 \times 4{\cdot}5 \times 12} = 1{\cdot}4 \text{ tons} = 3100 \text{ lbs. nearly.}$$

Now, the breaking load of this beam, as given in Experiment III, Table I, was nearly 9000 lbs., giving one-third of 9000 lbs. = 3000 lbs. for the load of safety. Hence it appears that in this truss beam we had very nearly hit upon a perfect adjustment.

Throughout these calculations, we have assumed that the section of the top flanch of the beam is duly calculated to balance the united tensile forces of the truss rods and the bottom flanch of the beam.

Let us now consider the question of economy as regards these beams.

Comparison of Cost.—In estimating the comparative advantages of different form of beams, we should always consider their ratio of cost for a given amount of strength. In order to apply this method of comparison to the case of trussed beams, let a = the cost of the beam without the trusses, a_1 = the cost of the truss rods, a_2 = the cost of their construction, w = the breaking weight of the beam without the trusses, and W the breaking weight with the trusses; then we have—

Comparative advantage of the trussed beam, that of the beam without the trusses being unity:

$$= \frac{a}{a + a_1 + a_2} \times \frac{W}{w} \quad . \quad . \ (1).$$

In the case of the beam experimented upon, we have—

$a = 4\frac{1}{2}$ shillings, $a_1 + a_2 = 4$ shillings, $w = 5800$, $W = 7400$; then by formula (1) we have—

Comparative advantage of the trussed beam:

$$= \frac{4\frac{1}{2}}{4\frac{1}{2} + 4} \times \frac{7400}{5800} = \tfrac{2}{3} \text{ nearly.}$$

That is to say, the advantage of the simple beam, as compared with the trussed beam, is nearly as 1 to $\frac{2}{3}$.

For the Journal of the Franklin Institute.

Description of an Instrument for Rapid Surveying. By Edward W. Serrell, Esq., Civ. Eng.

An article, in the *Journal* for September, headed "New Instrument for Rapid Surveying," suggests the propriety of describing one which I had in 1849.

I am not aware that any thing similar has been used, although the idea was taken from a telescope, described to me by Col. Rumford, three or four years previously.

Col. Hughes, U. S. Top. Eng., then in charge of the surveys for the Panama Railroad, sent me orders to have an accurate survey made of the Chagres river, from my camp, near the Rio Gatun, towards Gorgona; with a request that it might be done as quickly as possible.

I had only one assistant that could be spared from the division, but the old adage was verified, and necessity again proved the mother of invention.

I had a very good Young's transit, and an excellent thirty-inch German pocket telescope, with these an Instrument was *manufactured* in the course of the day, by Mr. T. M. Griffith and myself, in the following manner: We had no regular tools; a brad-awl, made of a wrought iron nail, a pair of pliers, a tack hammer, and an adjusting pin, and screw driver belonging to a level, constituted, I believe, with a pocket-knife, all our available apparatus.

In order to render the telescope rigid in the joints of the tubes, a *reed* about three-eighths of an inch in diameter was lashed firmly along its entire length. The telescope of the transit was then unscrewed from the trunnions, and a piece of hard wood, about two feet in length, substituted for it.

On either end of this beam there were blocks, hollowed transversely to receive the German telescope; they were made adjustable by wooden wedges, that a proper vertical plane might be given to the instrument; all the fastenings of the blocks to the beam, and the telescope to them, were made of *bees-waxed black thread.*

This being done, we had merely exchanged a small telescope for a large one on the transit.

How to fix the cross wires in the glass was the next difficulty; we however, made a very good diaphragm of a piece of *dry sugar cane*, with the pith scraped out, leaving it long enough to slide in the tubes, without changing the direction of its axis, while the focal distance was being regulated. But we had no platinum wire, or fine silk, to form the crosses with, but we *had* a pet monkey, and poor *Mono* was made to contribute his share in the emergency; three of the finest hairs, taken from near the root of his tail, supplied the deficiency, and proved an excellent substitute.

One was placed in the vertical plane, and two were stretched across the middle, about one-eighth the diameter of the field apart; at first, some difficulty was experienced in fastening the hairs to the diaphragm, as the sealing-wax used melted in the sun, and they changed their positions; notches were then substituted, in the end grain of the sugar cane, and answered the purpose.

A base line of a thousand feet was then carefully measured on the beach, and the transit so fitted placed over one end of it. We had in the camp, a fourteen feet pine leveling rod, fitted with a sliding target; to this rod at 0. feet, we secured a permanent view, and the rod being then placed at the opposite end of the base line, wrong end upwards, for convenience, an observation from the transit, was made upon it, and the amount of the visual angle, formed between the two horizontal hairs in the telescope upon the rod, was recorded by sliding the target down, until the upper and lower horizontal hairs cut its centre and the stationary vane.

When the telescope was level, and the rod plumb, the angle thus formed was isosceles, the rod forming the base, and by it a ratio was formed, which in this case, as the base line measured was 1000 feet long,

became a decimal quantity; the observation on the rod was between 7 and 8 feet for 1000.

With the apparatus thus fitted, in little more than twenty-four hours from the receipt of the order to make the survey, I started up the river, with two canoes, two Indians, an assistant, and three days' provisions.

By this plan, the force on the field was not sufficiently reduced to interrupt materially the surveys previously in hand, at least for a few days.

The assistant, having with him his note book, level rod, and ten pickets, with white rags tied to them, and an Indian to paddle his canoe, started ahead, and proceeded up stream as far as he could see the first station, there showed his rod, and put up a picket, an observation being taken from the starting point to the rod, the assistant recorded the reading, and left a bit of paper pinned to the picket with the same written upon it. With the instrument, the magnetic bearing and the angle from one line to another were taken.

Both parties then again entered their boats, the first one pushing on as far as he could see his last picket, and then took another position on shore.

While the rear boat was going from one picket to another, the line was plotted on a drawing board placed across the bows, the topography on either side of the river sketched, and the soundings, which were taken by the *Peloto*, who managed the canoe, recorded as we passed along.

At every ten stations we compared notes and exchanged pickets.

In this manner with an instrument so roughly made, we surveyed, sounded, sketched the topography, and mapped, nearly eighteen miles per day.

The work proved correct upon being connected with the theodolite lines, which were run for the railroad.

I have frequently, since, found situations where this instrument has been used to advantage.

AMERICAN PATENTS.

List of American Patents which issued from Aug. 8th, to Aug. 29th, 1854, (inclusive,) with Exemplifications by Charles M. Keller, *late Chief Examiner of Patents in the U. S. Patent Office.*

AUGUST 8.

61. For an *Improved Machine for Making Bricks;* R. D. Bartlett, Bangor, Maine.

Claim.—"I claim making bricks of crude, untempered, and unground clay, by the means herein described, or by any other means substantially equivalent thereto. 2d, The manner of forcing the clay, in the state in which it is dug, through the grating in small quantities at a time, by which means it is freed from the stones which it may contain, and prepared to be acted upon by the plunger. 3d, The method of accurately gauging the quantity of clay in each brick, and of submitting them all to a uniform pressure, by means of the hole in the side of the mould. 4th, The manner of arranging and operating the bulk-head, by which it is enabled to assist simultaneously in the formation of two bricks, one in each mould. 5th, The combination of the bulk-head and the plunger with the lever, the lever having sufficient play upon its fulcrum to enable it to operate in the manner set forth. 6th, I claim making the parts of the mould hollow, and heating them with steam."

62. For an *Improvement in Dumping Wagons;* Wm. S. Babcock, Stonington, Conn.

Claim.—"I claim the arrangement of the cast metal boxes or sockets, with boxes or sockets containing concave wheels, the convex track, grooved track, and hooks. Also, the arrangement of gearing drum, crank, ratchet, chains, &c., all operating in the manner set forth."

63. For an *Improvement in Tubular Bridges;* Eden A. Baldwin, Elmira, N. York.

Claim.—"I claim constructing a bridge by the combination of the longitudinal strips of wood, the transverse iron bands, and the arrangement for tightening the same from the inside by a screw and swivel, with the trestle or frame work for supporting a railroad track, and receiving the strain directly on the bands, whether the track be placed within the bridge or upon its top, and forming the cylindrical or tubular bridge of great strength, durability, and simplicity of construction."

64. For an *Improved Process of Imitating Marble and other Substances;* William Bowney, City of New York.

Claim.—"I claim the manufacture of imitations of marble and other substances, from cements or other materials analogous thereto, by the application of the requisite coloring matter, prepared as described, either to the surface of the cement, or to a polished surface or mould, by means of a syringe, or other analogous instrument."

65. For an *Improvement in Air Heating Stoves;* Nathaniel A. Boynton, City of N. Y.

Claim.—"I claim constructing the entire fire chamber of one single casting or piece."

66. For *Fire Arm;* Isaac W. Brown, West Springfield, Massachusetts.

Claim.—"I claim giving the cylinder a partial rotation by the cocking of the fire arm, and completing the movement necessary to bring the nipples successively under the hammer by the act of discharging the piece."

67. For an *Improvement in Preventing Rattling in Carriages;* William S. Chapman, Cincinnati, Ohio.

Claim.—"I claim the employment of blocks of india rubber, or equivalent elastic material, of the form set forth, between the ends of carriage shafts and the clips upon the axles, for the purposes of preventing wear, rattling, noise, and accident."

68. For an *Improvement in Cotton Presses;* Nathan Chapman, Mystic River, Conn.

Claim.—"I do not claim the toothed wheels with projections thereon, separately; neither do I claim operating the follower by means of chains; but I do claim forming the hubs of the wheels with recesses in them to receive the rods, when said chains are wound up on the projections on the wheels, in the manner described."

69. For *Improvements in Sawing and Planing Machines;* Daniel Close, Hammonsville, Pennsylvania.

Claim.—"I claim the arrangement of one or more saws to cut on the down stroke, in combination with one or more planes to cut on the up stroke of the cranks, whereby the sawing and planing are performed alternately, which tends to equalize the motion of the machine, and make both instruments work more smoothly, so that it takes very little more power to drive both than it would to drive either."

70. For an *Improvement in Rosin Oil Lamps;* Silas Constant, Brooklyn, N. York.

Claim.—"I claim constructing the tubular wick guide without any opening through it, except at or near its lower end, and making said guide of such a size as to allow a clear annular space between it and the wick for the oil to rise in around the wick, for the purpose of preventing the oil inside of the upper portion of said wick guide from mixing with the body of oil outside of the same, by which the oil in contact with the upper portion of the wick will be raised to a considerably higher temperature than the oil in the body of the lamp. Also, the regulating of the flame of the lamp by raising or lowering, in any convenient manner, the inner conical tube, which immediately surrounds the upper end of the wick."

71. For an *Improvement in Stop Motion for Speeders;* Lewis Cutting, Lowell, Mass.

Claim.—"I claim, 1st, The use of the independent hinged lever, rod, or wire, moving in guides for tripping the shipper and throwing off the belt, thus relieving the trumpet from any further duty in throwing off the belt than the mere raising of said lever, rod,

or wire, which makes its operation more certain. Also, in combination with the hinged lever, the interposition between the cam and trumpet of a guide so arranged as to give sufficient friction to the rooving, when it rises irregularly from the cam, to prevent the dropping of the trumpet, and consequent throwing off of the belt."

72. For an *Improvement in Manufacturing Pigments from Iron Ore;* J. H. Davis, Morristown, New Jersey.

Claim.—"I claim the process for making said colored pigments by the steaming of said ores, in addition to the usual process of selecting, pulverizing, and heating the same, for the purpose of obtaining pigments."

73. For *Improvements in Fire Arms;* Joseph C. Day, Hackettstown, New Jersey.

Claim.—"I claim, 1st, Connecting the barrel with the stock and stationary breech, by means of projections on its sides, having one part of circular and another part of wedge form, and fitting within recesses in plates, or other equivalents attached to the stock, which said recesses correspond in form with the circular part of the projections, but are wider than the wedge-shaped parts thereof, and thereby admit of a limited swinging movement of the barrel, for the purpose of exposing its rear end. 2d, The sliding collar sliding over the stationary breech and the rear end of the barrel, for the purpose of making a close joint between the barrel and breech. 3d, Though I do not claim the tube, the piston, ratchet bar, and spring, separately, or irrespective of the particular arrangement shown, I do claim their particular arrangement, whereby the following results are obtained, viz; 1st, A sure forward movement of the caps without the assistance of a spiral spring. 2d, Convenience for replenishing the tube without removing it from the stock; and, 3d, The explosion of a cap already on the nipple, without bringing another from the magazine."

74. For an *Improved Device for Grooving Boards;* Geo. C. Fisk, Dansville, N. York.

Claim.—"I claim the excavator or bitt, in connexion with rotary saws, for tonguing and grooving boards, at the same time that their surfaces are planed."

75. For an *Improvement in Melodeons;* Orange N. Frary, Ansonia, Connecticut.

Claim.—"I claim the method of using two sets of reeds in a melodeon with one set of keys, in such a manner as to combine any two, or all four of the parts, (each part containing one-half of a set of reeds,) at pleasure, by the aid of an air tight wind chest, and four valves."

76. For an *Improvement in Salt Packing Machines;* John G. Fulton, Middleport, O.

Claim.—"I claim, 1st, The conical stampers having radial grooves. 2d, The yielding tooth in this connexion to enable the commencement of the lifting action, without damage to the teeth."

77. For an *Improvement in Radiators;* John Gemmil, Mercer, Pennsylvania.

Claim.—"I claim the suspension, within a radiating case, of a deflector and regulator."

78. For an *Improvement in Brick Presses;* Josee Johnson, Fort Smith, Arkansas.

Claim.—"1st, The combination of the double cam or cams, at the end of the lever or levers, and attached to and acting upon the plunger or plungers, and their friction rollers. I further claim, for the purpose of operating the cut-off, the combination of the two levers with the friction wheels, or their equivalents, at the end of the sweep."

79. For an *Improvement in Fire Arms;* Daniel Knight, Salem, Indiana.

Claim.—"I claim the horizontal sliding hammer, combined with the operating mechanism which constitutes the trigger, in combination with the barrel, which has the nipple in its breech, when said barrel is arranged forward from the hand of the shooter, and in front of the protection shoulder formed by the tube."

80. For an *Improvement in Spring Bed Bottoms;* William H. Merriwether, New Braunfels, Comal County, Texas.

Claim.—"I claim the spring bottom construction, of zig-zag wire."

81. For an *Improvement in Refrigerators for Marine Engines;* Joshua Merrill and George Patten, Boston, Massachusetts.

Claim.—"We claim the concentric tubes, and the chambers above and below the same, whereby the condensed steam or hot water is conducted into annular spaces separated

into thin films, and brought into contact on both sides with cold surfaces, the cold water or cooling medium passing through one set of pipes, and around the others. We also claim providing a separate vessel or receptacle, through which the injection water drawn from the condenser by the air pump, is made to pass before entering the refrigerator, so as to permit the oil to be separated and drawn off from the water."

82. For an *Improvement in Buggies;* James S. M'Clelland, Jefferson, Indiana.

Claim.—"I claim the arranging of the body upon spring couplings, in such manner as that additional pairs or sets of springs shall come into action as the weight is increased on the body, and this, in combination with the fastening of the body forward of its centre to one set of springs, and in rear of its centre to another set of springs, so that the body may have a rocking motion transversely, and the tendency of the body to yield at one point be counteracted by its lifting the spring in another point."

83. For an *Improvement in Machines for Making Bricks;* John McMurry, Lexington, Kentucky.

Claim.—"I claim, 1st, The combination with one or more mould cylinders, having moulds arranged as described, of as many plunger heads and plungers as may be desired, said plunger heads being arranged to work readily to the cylinders, and operated by any suitable means, whereby they are caused to compress the clay in the moulds. 2d, Arranging two mould cylinders parallel with each other, and placing between them two plunger heads attached to the same rod, or otherwise arranged so as to work in a line or plane passing through the axes of both cylinders, and thereby to cause one to advance towards its cylinder to compress the clay in one or more of the moulds as the other recedes from its cylinder after a similar operation. 3d, The method of giving motion to the mould cylinders during the receding movements of their respective plungers, by means of the toothed wheels upon the cylinders, the levers on the cylinder shafts, and their pawls, and the coupling rod, which has arms with which the plunger heads come in contact at a proper time during their movements. 4th, The method of locking the cylinders during the advance of their respective plunger heads, and of setting them free to turn during the receding thereof, by means of the catches attached to the frame, the hooks connected with the plunger heads, and a spring applied to the catches."

84. For an *Improvement in Sofa Bedsteads;* Stanislas Millet, City of New York.

Claim.—"I claim, in combination with a spring bottom, the attachment of the sagging bottom to the hinged head and foot board, so that said sagging bottom shall be strained over the spring bottom, when the head and foot pieces are dropped to form a bed, and serve the purpose of a lining between the mattrass and the springs, when used as a sofa or lounge."

85. For an *Improvement in Machines for Graduating Carpenter's Squares;* N. Millington and D. J. George, Shaftsbury, Vermont.

Claim.—"We claim, 1st, The arrangement in a single frame of as many gravers as there are units to be divided, so as by the action of the cam wheel, or its equivalent, simultaneously to trace, of the proper length, each set of division and fractional lines. 2d, The balance-frame, with its appendages, to equalize the pressure of the spiral springs on the graver handles, so as to give the same depth of mark on the thin as on the thick end of the taper square. 3d, The inclined plane, with its appendages, for moving the square longitudinally, and dividing the inch into any desirable number of equal parts. 4th, The carriage, arranged to press the square up against the points of the gravers, by a cam or otherwise."

86. For an *Improved Spring Body Carriage;* Alexander Moffitt, Brownsville, Penna.

Claim.—"I claim the construction of the body of wheeled carriages of a pair of metal springs, so formed and arranged that the curved portions thereof supporting the seat, shall admit of greater flexion, while their connexion with the horizontal portions of said springs is kept up, thus uniting the hind axle and front bolster, for the purpose of reducing the weight and expense of construction."

87. For *Improved Wooden Pavements;* Samuel Nicolson, Boston, Massachusetts.

Claim.—"I claim to so combine or arrange the blocks or wooden portion of the pavement, that there may be cells or channels formed by such arrangement between them, as described, and for the reception of tar and gravel, or materials of like character, and that each cell or channel shall have a wooden bottom for the tar and gravel cement to

rest on, whereby, when the mass of tar and stone in each cell is pressed down by the wheels of carriages, it shall be prevented from being forced through the cavity, and be caused to be spread in lateral directions so as to maintain a firm and close joint between the adjacent blocks, such as will operate to prevent water from passing down between their joints."

88. For an *Improvement in Stone Dressing Machines;* C. T. Porter, City of N. York.

Claim.—"I claim, 1st, The employment of a rest having its face parallel with the contiguous face of the tool stock, when the said rest is rigidly attached to the ways in which the hammer and tool stock work, or forms part of the same frame therewith, and when the frame thus formed is provided with and swings from journals which fit in journal boxes suspended or supported in a suitable manner in the main framing of the machine, so that the ways may be adjusted to different angles of the surface desired to be cut on the stone, without changing the relation of the hammer, the tool, and the rest. 2d, Constructing the tool stock and arranging it relatively to the rest and the hammer, so that it is capable of vibrating, to allow the tool resting upon the surface of the stone to be carried back by the feed motion, and cause it to be driven by the blow of the hammer, not in the line of the direction of the blow, but forward, in or nearly in the line or plane of the surface desired to be produced."

89. For an *Improvement in Clover Separator;* Christian Reif, Hartleton, Penna.

Claim.—"I do not claim any of the parts of my machine, separately considered; but I do claim the arrangement of the sieves and carriers for cleaning clover seed."

90. For an *Improvement in Ventilating Railroad Cars;* Cheeny Reed and Brooks K. Mould, Chicago, Illinois.

Claim.—"We claim the method of ventilating railroad cars, by combining with a vessel or apparatus which receives a current of air through a spout or spouts by the motion of the train, or any equivalent therefor, and discharges it into the car, a hollow rotating cylinder, composed of one or more series of slats, or their open work, or the equivalent therefor, and partly immersed and rotating in water, so that as the air passes through the said cylinder, or its equivalent, on its way to the inside of the car, the dust shall be separated therefrom by impinging on the moistened surfaces, whilst the rotation of the said cylinder in water has the effect to wash off the accumulated dust, and to keep the surfaces presented to the passage of the air constantly in a moistened state."

91. For an *Improvement in Machines for Cutting Boot and Shoe Soles;* Luther Ross and Potter G. Ross, Worcester, Massachusetts.

Claim.—"We claim placing the curved knives upon an axis, so that their cutting edges shall correspond to portions of the surface of the cylinder, so that a small portion only of the knife is cutting at any one time, for the purpose of cutting soles for boots and shoes. We claim the driving of the feed rolls by the adjustable wheel, in combination with the arrangement of the table and guide rail."

92. For an *Improvement in Cartridges;* Horace Smith and D. B. Wesson, Norwich, Connecticut.

Claim.—"We claim the employment in the cartridge of the metallic or indurated disk or seat plate, so that it shall rest directly on the powder, in combination with arranging the priming or percussion powder in rear of said disk, or on that side of it opposite to that which rests against the powder; our said arrangement of the disk and priming affording an excellent opportunity for applying the force of the blow by which the priming is inflamed, such force being applied in the line of the axis of the cartridge."

93. For an *Improvement in Lard Lamps;* Ira Smith and John Stonesifer, Boonsboro', Maryland.

Claim.—"We claim the improved piston, composed of two adjustable compressing plates that embrace between them a disk of leather, or other equivalent material, the said disk having an outwardly tapering independent piece, inserted into a corresponding shaped recess, so that as the periphery of said piston wears away by use, it may be enlarged by simply loosening its compressing plates, drawing out said piece a short distance, and then tightening said plates, and trimming off to the proper curvature the extremity of the piece."

94. For an *Improvement in Car Coupling;* Thomas B. Stout, Keyport, New Jersey.

"The nature of my improvement consists, 1st, In a device consisting of a stop affixed

to the floor of the buffer, for holding a swung coupling bolt in connexion with a forked lever and springs, by which the ordinary link or coupler is secured on the bolt when in place, yet allowing the displacement of the lower end of the swung bolt, when the cars are being thrown off the track, and at an angle thereto bring the middle of the link in contact with either side of the buffer jaws, and thus allow of self-detaching."

Claim.—"I claim the arrangement of the stop, springs, coupling bolt, in connexion with the ordinary link, for the purpose of admitting of self-detachment of the cars by the end of the bolt being thrown. Also, said stop, springs, bolt, link, in combination with the forked lever operated by the windlass, for the purpose of detaching in safety a car or cars at the will of an attendant, while the train is in motion."

95. For an *Improvement in Applying Springs to Window Sashes;* Albert G. Safford, Boston, Massachusetts.

Claim.—"I claim the slide or slides, and the springs, with respect to the window sash and the rectangular groove of the stile or jamb of the frame, whereby the two sides of each slide are pressed at once by the springs against the two right angular sides of the groove, and the sash forced in two directions, and particularly against the weather side of the groove."

96. For an *Improvement in Machines for Cutting Boot and Shoe Soles;* J. Thompson, Marblehead, and A. S. More, Lynn, Massachusetts.

Claim.—"We claim, 1st, The combination of the sector and pinion with the cylinder and clamp spring, operating in the manner described. 2d, We do not claim the mere adjustment of the crank and eccentrics on the shaft; but we claim communicating both a vertical and intermittent rotary motion to the knives from the continuous motion of the fly wheel, by the eccentric operating the vertical slides which support the cutter shaft, and the geared cylinder, or its equivalent, engaging and disengaging with said shaft, and operated by the sector, or its equivalent, the motion of which is derived from the crank, whereby we are enabled to secure the partial ascent of the knives before the commencement of their revolution, by the proper adjustment of the eccentrics to the crank. 3d, Passing the screws which confine the knives to the cutter head through the sliding boxes, for the purpose of adjusting the knives to different widths of toe and heel, without loosening the screws which confine them to the cutter head."

97. For an *Improvement in Hame Fastenings;* Edward Turner, Baltimore, Maryland.

Claim.—"I claim a curved rack fitted to traverse in a groove provided with a vibrating catch operated by a spring."

98. For an *Improvement in Furniture Casters;* Philos B. Tyler and Benj'n. Lathrop, Springfield, Massachusetts.

Claim.—"We do not claim the metallic caster roller, but we do claim the caster roller as made, both externally and internally, with a bended rim united to an annulus or disk, made flat for some distance from the rim towards the hub, the bended rim and flat disk producing a saving of the usual amount of metal which would have to be employed in the angles between them, in order to insure the requisite strength and stiffness to the roller."

99. For an *Improvement in Self-Heating Smoothing Irons;* William Wickersham, Boston, Massachusetts.

Claim.—"I claim the making of the handle in part or in whole, the reservoir for containing the combustible fluid. Also, combining with the bottom of the flame chamber one or more connexions or columns extending therefrom, and for the purpose of intercepting heat and conducting it downwards into the bottom of the flame chamber. I do not claim the mere application of a non-conducting material to a surface, in order to prevent the escape of heat therefrom, but I claim the non-conducting material arranged on the top of the iron, in combination with conductors leading from the top of the flame chamber down to the bottom of said flame chamber, by which combination the surplus heat in the top of the flat is saved and conducted into the bottom of the iron."

100. For an *Improved Document File or Holder;* H. E. Woodburg, Washington, D. C.

Claim.—"I claim the box or compartment document file, consisting of a box part and spring plate or holder, the said holder being hung or attached to the spring at its back in such a manner as to give a flexible character to the holder, and admit of its being

leaned back or to either side, to facilitate the reading of the endorsements, and the abstraction from or insertion of certain papers to the pile, without releasing the other papers from the hold of the platen, and the whole forming a more convenient file for the filing away of folded documents, and to protect them from abrasion, &c."

101. For an *Improvement in Shuttle Guards for Power Looms;* Peter Migget, Hoosick Falls, New York.

Claim.—"I claim the shuttle box-guard constructed of rollers on either side of the centre longitudinal line of the shuttle, and projecting from a spring bar or holder down into the box, whereby the shuttle is more effectually restrained from rising at the end next the warp on leaving the box, thus preventing the shuttle from flying out of the loom, or more truly inclining it to run in its course, friction is diminished, the shuttle less exposed to injury or wear, and kept from turning or entering the opposite box edgewise."

102. For an *Improvement in Furniture Casters;* Leroy S. White, Chicopee, Assignor to Benjamin Lathrop and Philos B. Tyler, Springfield, Massachusetts.

Claim.—"I do not claim making the shank of the caster detractable from its socket, nor do I claim the employment of a spring to hold it in the socket, nor the arrangement of said spring in a groove made in and around the shank, and making the spring to bear against the internal surface of the socket, made without a groove; nor do I claim the arrangement of the sustaining groove of the spring in the socket instead of in the shank, so that when the shank is being drawn out of the socket, or when it is within or out of the same, the spring will remain in the socket; but what I do claim is, the mode of arranging or applying the spring and the sustaining groove or recess thereof, to the socket tube and the shank, the sustaining groove of the spring being made to embrace the socket tube, and project through and into the groove of the shank."

103. For an *Improvement in Sewing Machines;* Alfred Swingle, Assignor to Elmer Townsend, Boston, Massachusetts.

Claim.—"I claim the combination of the rotary fork thread carrier and the hook, as made to operate in connexion with the needle, and perform sewing."

104. For an *Improvement in Blasting Rock, Timber, &c.;* John Norton, Cork, Ireland.

Claim.—"I do not claim the percussion cartridge, the frictional pill box, or the frictional cork, as herein described; but I do claim, 1st, The frictional cord divided in two parts and slightly spliced together, in combination with an inflammable compound with which the splice is covered, as described. 2d, The safety bridle guard, constructed and applied as described."

105. For an *Improved Mode of Constructing Iron Buildings;* Amos J. Saxton, Brooklyn, New York.

Claim.—"I do not claim the mortises, tenons, lugs, grooves, chamfers, common keys, or any simple dove-tail joints. I claim, 1st, The process of connecting and combining all the different points by all or any of the improved joints, so arranged at all the different points by all or any of the different joints, as when joined by the different joints at the sectional points, as described, the use of screws, rivets, bolts, or nails, is not required in the erection of iron frame, fire proof, or other buildings. 2d, I claim the process of erecting iron fire proof and other buildings, and of uniting or connecting each substantial part to each other, or of connecting them at all of the sectional points, by the different joints, without the use of screws, rivets, bolts, or nails. 3d, I claim the manner of so arranging and combining the different points of the columns, post, or studs, girders, beams, ashlers, and interior plates, or any of the sectional parts of the buildings, with the different joints so combined, in such a manner as when the different joints are properly united and combined with the different joints in all of the sectional parts, they form a substantial iron frame fire proof, or other building."

106. For an *Improvement in Bushing Sheaves for Ships' Blocks;* Weatherell Taylor, Camptown, New Jersey.

Claim.—"I claim securing the bush to the sheave by fitting the flanch into the recess on one side of the sheave, and the bevel edged ring into the recess on the opposite side of the sheave, and swagging the bush on to the beveled edge of the ring."

107. For an *Improved Fan Blower;* Solomon W. Ruggles, Assignor to S. W. Ruggles and A. R. Smith, Fitchburg, Massachusetts.

Claim.—"I claim the application of a deflecting rib to the middle of, and so as to ex-

tend beyond the propelling surface of each of the curved wings of the blast wheel, and formed so as to deflect the currents of air entering the wheel laterally in the opposite directions, and prevent them from that contact or impulsion against one another, which produces the humming or buzzing noise."

108. For an *Improvement in Braiding Machines;* James A. Bazin, Canton, Assignor to Alfred B. Ely, Boston, Massachusetts.

Claim.—"I claim the movable guides, constructed and operating in the manner described. 2d, I claim the method of constructing the bobbin holders, the parts which carry and guide the threads being connected with the stem by means of springs which enables the bobbins to yield without permitting the strand to render too freely. 3d, And I also claim, in combination with the method of constructing the bobbin holders, the method of drawing off the finished braid over the spring plate. 4th, I claim the disk, operating in the manner described."

AUGUST 15.

109. For an *Improvement in Closing the Mouths of Bottles, etc., Air Tight;* Robert Arthur, Washington, District of Columbia.

Claim.—"I claim only the vessel, so contrived as to be made tight by means of a groove or receptacle containing a yielding medium which is to be penetrated by the cap or cover, with the receptacle so contrived that the bottle may be inverted to pour out its contents without spilling the liquid or yielding medium from the groove or receptacle."

110. For an *Improvement in Machines for Pegging Boots and Shoes;* John A. Bradshaw, Lowell, Massachusetts.

Claim.—"I claim the combination with the grooved wheel, the arm, for the purpose of presenting the pegs to the wheel longitudinally. The application of the grooved wheel, in combination with the burr wheel and tube. The levers, pawl, and ratchet, on grooved wheel, or their equivalents. The clamps or forceps to receive the peg from the wheel, in combination with the detectors, the punches, and the double channel, for the purpose of insuring the proper presentation of the peg with the point downward. The combination of the forceps, the wedge-shaped driver, and the adjustable stop screw. The apparatus for holding the boot or shoe during the operation of pegging, consisting of the plate revolving upon the ring of the plate, and having the clamps, or their equivalents. And the combinations of the hinge joints, the shaft, and the levers, or their equivalents."

111. For an *Improvement in Glass Moulds;* Wm. Brooke, Jersey City, New Jersey.

Claim.—"I claim the shoulder, when used in combination with the cap plate, in the manner set forth."

112. For an *Improvement in Hot Air Range and Side Ovens;* John H. Cahill, Philadelphia, Pennsylvania.

Claim.—"I claim, 1st, The use of the fresh hot air pipe, when constructed and combined with the hot air chamber, and elevated side oven and vent hole, especially for the purpose of preventing the fumes or vapors, (arising from the substances being cooked in the oven when in operation,) from being drawn or forced out by the oven into the hot air chamber. And, 2d, Making the elevated side oven flues of square section, and united together by the partitions, so as to leave equal and flat surfaces in the oven and hot air chamber, and arranged so as to radiate heat therefrom on all sides of the oven excepting the door side, and also so as to radiate heat into the hot air chamber from the flues on four sides of the oven."

113. For an *Improvement in Railroad Car Brakes;* M. P. Coons, Brooklyn, N. York.

Claim.—"I claim a lever form brake, which, when in action, shall bear and brake simultaneously, both upon the wheels and rails, the friction upon the latter supplying the breaking force upon the former, and the whole being adjustable and self-acting, through the combined agency of an eccentric or cam-bearing or resting point between the brake and car."

114. For an *Improvement in Machines for Turning Irregular Forms;* A. D. Crane, Newark, New Jersey.

Claim.—"I claim the cutting wheel, combined together, guided and controlled in the manner set forth."

115. For an *Improvement in Rakes;* D. M. Cummings, Enfield, New Hampshire.

Claim.—"I claim the mode of fastening the head of the rake to the handle or tail, by the use of the head fastener containing the socket and the clasp, in combination with the handle, the head, and the screw."

116. For an *Improved Hand Press;* B. Franklin Day, Philadelphia, Pennsylvania.

"The nature of my invention relates to the method of arranging the levers, toggle arms, and follower, so that by grasping the said levers in the hand, the follower will be brought down to the block or bed; that is to say, by hinging the hand levers to the stock, and the follower to the hand levers, by means of the toggle arms."

Claim.—"I claim the so arranging of the levers, toggle, and follower, as that by grasping the handles of the levers in the hand of the operator, the platen shall be brought down hard upon the bed."

117. For an *Improved Mode of Securing Hubs to Axles;* Cook Darling, Utica, N. Y.

Claim.—"I do not claim the holding on the wheel by means of a groove encircling the front end of the axle; nor operating the guard plates or collar closing over the groove, by means of the key in front, nor simply the conical end of the axle; but I claim the combination and arrangement of the several parts, viz: the axle with the conical end, the guard plates, and the means of operating the same by the use of the key in front."

118. For an *Improvement in Punches and Dies for Punching Watch Hands;* Aaron L. Dennison, Roxbury, Massachusetts.

Claim.—"I claim the construction and arrangement of the punch and die, the punch being of elementary parts formed to the same figure, or nearly so, in their cross-section throughout their whole depth, and braced between blocks or clamps made to the figure of the article to be formed, by which construction the most delicate and complex punch can be formed in a cheap and expeditious manner, and readily renewed or changed, and being throughout of the same magnitude, are readily and perfectly hardened without injury, which has heretofore been found an insuperable difficulty in punching small delicate work."

119. For an *Improvement in Ploughs;* Joshua Gibbs, Canton, Ohio.

Claim.—"I claim making the working surface of the mould board in the form of a section of the interior surface of a hollow cylinder, the centre or axis of said cylinder being parallel, or nearly parallel horizontally to the base of the mould board or bottom of the plough."

120. For an *Improvement in Lamps;* Joseph Harris, Jr., Boston, Massachusetts.

"The nature of my invention consists in a new mode of producing a centre draft in lamps; also, of increasing and decreasing the light."

Claim.—"I claim the arrangement and construction of the lamp."

121. For an *Improved Safety Apparatus for Steam Boilers;* A. H. Judd, St. Louis, Mo.

Claim.—"I claim passing the stem of the valve through an enlargement in its supporting tube, by which I am enabled to give short bearings to said stem, for the purpose of preventing it from becoming fastened in its bearings by oxidation, or the action of the heat upon the earthy matter driven through the same when the valve is opened, and also for the purpose of producing a fuller and clearer sound when the valve is opened, than is produced by the escape of steam through the ordinary gauge cock. Also, removing portions of the sides from that part of the valve stem which passes through its inner bearing aperture, so as to leave narrow bearing surfaces to guide and steady the valve, for the purpose of preventing said valve stem from becoming fastened within its inner bearing aperture, and also for causing a large volume of steam to escape and give the alarm when a leak of water in the boiler, or excessive heat of the steam, causes the float to sink. Also, combining the valve stem with the float, in such a manner that when the float shall sink and open the valve, the valve stem may be detached therefrom, for the purpose of again closing the same, by simply giving a partial turn to said valve stem by means of its handle. Also, giving an alarm whenever the steam in the boiler is allowed to accumulate to a dangerous degree of pressure, by placing a plug of fusible alloy in an aperture in one end of the float, which is connected with my improved arrangement of gauge cock."

122. For an *Improved Grindstone Frame;* J. L. Lord, Chester, Connecticut.

Claim.—"I claim the grindstone frame, cast in two pieces of such form that when

put together it shall furnish the bearing for the shaft and friction roller, both of which shall be protected from injury and from dust or water, and also from being displaced from their positions in the frame, either by accident or design."

123. For an *Improvement in Railroad Car Brakes;* Thos. G. McLaughlin, Philadelphia, Pennsylvania.

Claim.—"I claim forking the sliding rod in such a manner as not to interfere with the king joints and bumpers, but to have a longitudinal motion separate from and independent of both. Also, the slotted connecting rods attached to the sliding rod for causing the automatic action of the brakes without interfering with the ordinary hand brake, or the hand brake in its action interfering with or producing any movement of the sliding rod."

124. For an *Improvement in Harrows;* Jacob Myers, Powhatan Point, Ohio.

"The nature of my invention consists in the construction, on the teeth of the harrow, of oblique wings, the teeth being arranged upon a beam running obliquely to the main beam of the implement."

Claim.—"I claim the triangular wings upon the turned up portion of the teeth with thin land sides, so inclined as to have a tendency from the plant, when the implement is moving forward, constructed and arranged for pulverizing the earth, and otherwise facilitating the cultivation of cotton."

125. For an *Improvement in Lime Kilns;* Robert Neisch, City of New York.

Claim.—"I claim, in combination with the fire chamber, the air conducting passage, for the purpose of bringing in the air from above the fire. Also, in combination with the arched fire chamber, the inclined and curved hearth, for concentrating the fuel and throwing the flame or heat towards the stack."

126. For an *Improved Mode of Unloading Coal and other Cars;* Andrew Patrick, Alleghany County, Maryland.

Claim.—"I claim the manner of liberating the pin which holds the door of the car, by a lever attached to said pin, calculated to lift it and open the door when the car enters upon a tilting frame. Also, the iron bar upon a tilting frame forming a hook to hold the car, and, at the same time, a means of lifting the lever to open the door of the car, or, in other words, the combination of this lever and tilting frame to facilitate the unloading of mine cars."

127. For an *Improvement in Sewing Machines;* Sylvester H. Roper, Worcester, Mass.

Claim.—"I claim the groove, tube, or thread passage, in combination with a needle made to operate a thread, said passage being for the purpose of supporting the thread and preventing it from kinking or injuriously springing back or towards the cloth, immediately after the release of the thread from the needle. I do not claim the intervention or employment of a slide, or an equivalent contrivance, to close down on the barb and over the opening of the hook of a needle; nor do I claim the application of such closing slide to a hook needle in such manner that said slide shall play or move in a groove made in the side of the needle, as the same does in the machine patented by William Wickersham on the 19th day of April, 1853; but what I do claim is, the making the shank of the needle tubular, and inserting the closing slide within the same, whereby such closing slide is better protected from accident, or being broken by catching in the cloth or thread, or otherwise broken, as it is liable to be, when made to run in a groove formed in the side of the needle. And, in combination together, and used with a hook needle, I claim the two thread benders, as made to operate on the thread, and lay it in the opening of the needle. And, in combination with the thread benders, I claim the lip or nipper, and the spring nipper, the same being for the purpose of seizing the thread and enabling the needle to draw it closely into the cloth. I also claim the mode of connecting the two connecting rods to one crank pin, viz: by the projections from the rods and the covering tube or ferule."

128. For an *Improvement in Turn Tables;* Jacob C. Robie, Binghampton, N. York.

Claim.—"I claim balancing the platform of the turn-table upon a transverse central shaft, or other suitable axis, resting on the roller carriage in a line intersecting the line of the axis upon which the turn-table rotates, in such a manner that the table, when in a horizontal position, is elevated, or has its rails above those of the track, to admit of the free swing of the table over its under supports or bearings, and so that the table may be

rocked with facility from its centre, or tilted to bring the ends of its rails on either side of the balancing shaft, into line or level with the rails of the track. Also, the manner of holding the table steady at its horizontal set whilst rotating, and tilting or depressing it on either side of the balancing axle when required, by means of the cams arranged to bear upon the roller carriage, and operating in connexion with the roller carriage and table."

129. For an *Improvement in Machines for Cutting Irregular Forms;* O. L. Reynolds, Dover, New Hampshire.

Claim.—"I claim combining a series of patterns and the chucks for the blocks with the collar, the vertical slides, the pawls, the ratchet wheels, and the recesses in the arms, or their equivalent, in such a manner that said series of patterns shall have corresponding compound rotary and longitudinally reciprocating movements imparted to them. Also, supporting the weight of the cutter wheel upon a series of rotating and longitudinally reciprocating patterns when said patterns are combined with chucks for a series of blocks, in such a manner that corresponding movements shall be imparted to said patterns and blocks, and said blocks be so situated as to be operated upon by the cutters."

130. For an *Improvement in Machinery for Combing Wool;* Charles G. Sargent, Lowell, Massachusetts.

Claim.—"I claim, 1st, Drawing out and stapling the material previous to commencing the combing operation. 2d, The continuous motion of the nippers, or other parts which operate upon the wool, whereby I am enabled to keep a number of them in operation at the same time, the different steps in the process proceeding simultaneously upon different portions of the material, without the necessity of interrupting any one of them for the performance of another, and without retrograde motion of any of the parts of the machine. 3d, The method of opening and closing the nippers by means of the cam, in combination with the cam, or its equivalent, whereby the nippers are closed suddenly upon the wool, whatever may be the rate of motion of the nipper cylinder."

131. For an *Improvement in Railroad Car Windows;* George Spencer, Utica, N. Y.

Claim.—"I claim the combination with the side of a car of a revolving window, consisting of two separate circular sashes connected by hinges, so that one sash may be opened to its full extent, and having a small part of the circle cut off, so that by revolving it upon its centre, a small opening may be made at the forward part of the window, which ever way the car may be moving, the residue of the window remaining at the same time covered.'

132. For an *Improvement in Fire Arms;* William A. Sweet, Pompey, New York.

Claim.—"I claim, 1st, Producing the compound longitudinal and vibratory movement of the breech, and afterward immovably securing it in contact with the barrel by a single forward and return motion of the actuating lever, viz: by means of the cam piece provided with a shoulder, a cam surface, and a wedge surface, against which, said lever acting successively, produces respectively the backward longitudinal and vibratory motion of the breech, then the forward longitudinal motion thereof, and finally presses it against the barrel with immense force. Also, the link, one end of which is hinged to the lever, and the other end provided with a slot that receives a pin on the hammer dog, when arranged and operated for the purpose of cocking the gun by the action of the actuating lever in operating the breech, while, at the same time, the hammer remains free to be raised in the ordinary way without moving said lever. Also, the arrangement of a broad cavity in the face of the hammer, with a sharp edge on its rear side, in combination with the compound movement of the breech, and the properly regulated motion of the hammer, for the purpose of removing the exploded caps from the nipple. Also, the combination of the mouth-piece, attached to the extremity of the feeding tube, and provided with a notched tongue projecting forward from one side, and of the short tube which is held in front of said mouth-piece by a spring, and has a wedge-shaped projection extending forward from the side, opposite to the tongue, when the whole being situated and arranged in such a manner as to receive the nipple and supply it with a cap whenever the breech is fully opened."

133. For an *Improvement in Seed Planters;* J. P. Wait and L. J. Wait, Waterloo, S. C.

Claim.—"We claim making one wheel larger than the other, and putting them on separate axles, so as to make one operate the bur, or apparatus which stirs the seed, and

the other the burr or apparatus which delivers the seed, without the aid of gearing or other equivalent devices."

134. For an *Improvement in Horse Rakes;* Moses D. Wells, Morgantown, Virginia.

Claim.—"I claim the method of regulating the action of the rake teeth by the reverse anti-friction rollers."

135. For an *Improvement in Insulators for Lightning Rods;* Timothy W. Webb, Jersey City, New Jersey.

Claim.—"I claim making the inner surface convex, in the manner described."

136. For an *Improved Process for Printing Long Napped Fabrics;* Wm. A. White, Roxbury, Massachusetts.

Claim.—"I claim the process of coloring and finishing a napped fabric after the fibres have been laid in one direction by the ordinary or common process of finishing them, the said process consisting in raising and turning the fibres over and down upon the cloth in a contrary direction, and printing figures or devices upon them, in one or more colors, and finally returning the fibres or restoring them to their original positions or directions."

137. For an *Improvement in Gold Amalgamator;* A. S. Wright, San Francisco, Cal.

Claim.—"I claim the method for amalgamating gold in hollow revolving cylinders, upon horizontal axes, said axes, journals, or trunnions being hollow to admit the pulverized quartz or ore from one cylinder into another, the inlets through the trunnions being smaller than the end of the outlet; the said cylinders connected by flanches or pipes with grooves turned into the axes or trunnions, and rings fitted into the grooves, and covered by the flanches, the whole being so connected as to make them water or steam tight, and so arranged as to give a fall of about six inches to each cylinder, said cylinders containing rollers, knives, burnishers, and other analogous arrangements, to produce friction, scour the ore, and produce the amalgam with quicksilver."

138. For an *Improvement in Machines for Pegging Boots and Shoes;* Wm. Ridder, Assignor to Wm. Ridder and Nehemiah Himet, Newburyport, Massachusetts.

Claim.—"I claim the combining with the handle of the machine, and the machinery for driving the pegs, a feeding mechanism, by which, under the movement of the awl stock, the feeding, or regulating of the feeding of the machine along on the sole, is effected. Also, the combination of mechanism, by which the feeding of the machine is regulated while the machine is held in the hand and pressed against and along on the edge of the sole, the said combination being the serrated wheel, the spring catch, the slide, and the cam on the awl driver or stock. Also, the combination of the movable or sliding peg receiver with the peg wood carrier and the awl driver or stock, the same being applied and made to operate as stated."

139. For an *Improvement in Winnowers;* Henry H. Beach, Chicago, Illinois.

Claim.—"I claim the board, (delivering the grain to the front edge of the blast,) in its arrangement with the drum and the inclined planes."

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140. For an *Improved Centrifugal Pump;* William D. Andrews, City of New York.

Claim.—"I claim the construction of the pump, as described, viz: having a hub in the shape of the base of a cone inverted, with arms attached to its periphery of a gradually decreasing width as they approach its base, placed within a shell corresponding in shape to the outer circumference of the arms, and having induction passages of a spiral form gradually decreasing in pitch to their point of delivery, and eduction passages of a spiral form, of a gradually increasing pitch until they attain a straight line; by which construction the water is made to pass without sudden change of direction or eddies in an unbroken volume through the pump. I do not limit myself to the precise mechanical construction, as shown, but may modify the different parts, only retaining the same general combination."

141. For an *Improvement in Hot Air Furnaces;* Nathaniel A. Boynton, City of N. Y.

Claim.—"I claim, 1st, The arrangement and construction of the dome and heating ring surrounding the same, combined by a series of pipes opening into the base of the dome, and carrying the smoke up over the same. Also, the construction and arrangement of the smoke pipes, so as to prevent the lodgement of dirt therein, and precipitate

the same into the fire chamber, thereby preventing the clogging of said pipes. Also, the puppet valve cover, arranged and combined with the dome of the furnace, by which I insure a stopper at that point not liable to the derangement of ordinary valves used for similar purposes."

142. For an *Improvement in Rotary Engines;* Richard C. Bristol, China, Michigan.

Claim.—"I claim the resting of the outer cylinder by lugs upon a convex bearing, with a plate interposed and made adjustable by set screws, or by wedges, for the purpose of adjusting the outer cylinder to any and all possible variations of the shaft and inner cylinder. Also, driving out the slides by steam acting under pistons at each end of them, two being drawn out in equilibrio, while the other two are being acted against to propel the engine. Also, using a cock or valve in the exhaust pipe, to be closed before starting the engine, for the purpose of filling the engine with steam, and causing the pistons to force out the slides, which fall back upon stopping the engine. Also, the metal rings upon the outer head, fitted over elastic packing, and forced up to the ends of the cylinder by springs, for providing for the expansion and contraction of the metals. Also, in combination with the rings thus forced up, the use of set screws for restraining the action of such springs, and preventing the atmosphere from causing undue pressure or friction on said rings. And, also, the peculiar method of making the joint in the abutment, so as to be adjustable and perfect on the face of the inner cylinder at the end of the abutment and on the periphery of the inner heads."

143. For an *Improvement in Hominy Mills;* Benjamin Bridendolph, Clear Spring, Md.

Claim.—"I claim the compound spiral hulling shaft, operating in connexion with a roughened concave for hulling and breaking corn."

144. For an *Improvement in Straw Cutters;* Absalom B. Earle, Franklin, N. York.

Claim.—"I claim the arrangement of a vibrating knife and recoil spring, as set forth. Also, the arrangement of a chopping knife on vibrating arms fitted on each side with a handle, in such manner that the force of the blows of the knife may be varied in proportion to the quantity of straw to be cut, and by which the operator may work on either side of the machine at pleasure."

145. For an *Improved Arrangement of the Steam Engine;* Wm. M. Ellis, Washington, District of Columbia.

Claim.—"I claim the arrangement of the annular cylinder and piston between the crank and cross-head, and uniting the two latter by a connecting rod passing through the space within the two former."

146. For an *Improved Stop and Waste Cock;* Wm. Z. Hatcher, Philadelphia, Penna.

Claim.—"I do not claim making a supply way in the barrel of the cock, the outlet waste hole, the waste pipe, nor the through ways; but I claim making the waste way in the barrel of the cock, so as to convey the water required to be wasted from the pipe to the through way in the plug, that it may pass through the same to the outlet hole and pipe on the opposite side of the barrel, and so that the plug may be turned in either direction for the purpose, and the notch or extra hole in the plug, and the check pin and stops heretofore used may be dispensed with."

147. For an *Improvement in Portable Bureaus;* Levi Heywood, Joseph L. Ross, and Jas. K. Otis, Boston, Massachusetts.

Claim.—"We claim forming in a bureau or case of drawers which is susceptible of dismemberment, an independent frame or case, which, when the parts are disjointed, and the back of the bureau attached to it, serves as a box or case to receive the front, back, and end pieces of each drawer, the pieces which compose each drawer being packed in the same compartment of this independent frame, in which the said drawer slides when put together."

148. For an *Improvement in Apparatus for Coating Telegraph Wires;* James B. Hyde, City of New York.

Claim.—"I claim the employment of the moulding kettle, with or without the melting kettle, provided and combined with an aperture covered with a disk of india rubber, or its equivalent, having a hole or puncture in the centre which admits the wire and prevents the escape of the contained composition, and with the nozzle or die, for determining the thickness of coating of compound to be put on the wire. And, also, the use of

the cone, (which determines the thickness of the coating,) in such manner as that the outer end or nozzle thereof shall, when in use, terminate in and be covered by water, so that the covered wire shall emerge from the cone directly into, or while the latter is in the water, through which the wire will then pass, for the purpose of cooling the composition. And, finally, I do not claim the use of the apparatus solely for the purpose of covering telegraphic wires, but it may be applicable and useful for other equivalent uses."

149. For an *Improvement in Actuating Engines by Bi-Sulphuret of Carbon;* Bernard Hughes, Rochester, New York.

Claim.—"I claim the application of bi-sulphuret of carbon to any convenient form of the steam engine, as a motive power, when the vapor of said substance, after it has passed through the cylinder, is condensed by any known means of producing condensation, in a suitable reservoir, and preserved for the future supply of the boiler."

150. For an *Improvement in Knitting Machines;* George Jackson, Cohoes, N. Y.

Claim.—"I claim the arrangement and combinations of the pressers and sinkers in the frame, in the manner whereby they move together and can be adjusted at such distance apart as may be requisite to graduate the size of the stitches, as required. Also, the arrangement of the cams which are attached to the cam wheels on one common shaft, to produce the relative movements of the pressers, the sinkers, the needles, and the thread carrier bar, with the carriers, in combination and co-operation with the movement of the face cam, which cam being revolved by the movement of the shaft through the spur gear wheels, produces the relative movements of the thread carriers to the right and left, and under and above the needles, and gives the peculiar character and figure of the fabric knit, so that by changing the surface of the face of cam, and altering the relative proportions of the spur wheels to each other, the figure of the fabric may be altered indefinitely."

151. For an *Improvement in Floating Drags or Anchors;* A. F. Lewis, Shopiere, Wis.

Claim.—"I claim the arrangement of the canting hawser, cable, and floating anchor, whereby a vessel may be held with more or less power, as circumstances require, where ground anchorage is unattainable."

152. For *Apparatus for Balancing and Hoisting Sashes;* Robert Marquis, Xenia, O.

Claim.—"I lay no claim to making both sashes mutually operative by means of the same cords which serve to elevate and lower said sashes; but I claim the single cord, which, passing around pulleys at the mid-width of the sashes, is operated by a winch in the jamb, enabling the simultaneous or separate movement of each sash without liability of binding by the unequal expansion of different portions of the cord, or impairing the strength of the sash by the removal of its substance, and for other objects of utility."

153. For an *Improvement in Manure Spreaders;* Elbridge Marshall, Clinton, N. J.

Claim.—"I claim the employment of the vibrating brush."

154. For an *Improvement in Grain Mills:* Henry Mellish, Walpole, N. Hampshire.

Claim.—"I claim the arrangement of the ring saws, as set apart by the washers on the bolts, with the cracker rest inclosed by them, in combination with the adjustable case, or its equivalent, for the purpose of cracking ears of corn, and also shelled grain, that it may be the more readily received between the burr and the grinding surface of the adjustable case, and for the further purpose, by the oblique direction of the teeth on the outer edges of the ring saws, and that of the teeth on the inner surface of the adjustable case, of forcing the cracked grain into the space between the periphery of the burr and the grinding surface of the adjustable case. Also, the arrangement of the burr, constructed as above described, in combination with the finishing plate, and the adjustable case, or its equivalent, operating as the burr does, conjointly with the ring saws, or inside the adjustable case, and the toothed disk of the finishing plate against the front surface of the adjustable case, for the purpose of further grinding and giving the required degree of fineness to the meal as it passes between them."

155. For an *Improved Diaphragm Pump;* Julius A. Pease, City of New York.

Claim.—"I claim the elastic diaphragm, with the metallic or wooden cylinder, in combination with the air chamber."

156. For an *Improvement in Wood Gas Generators;* W. D. Porter, City of N. York.

Claim.—"I claim the construction of a gas apparatus or still, consisting of a metallic or other cylinder, the cones, diaphragm plate, and exit pipe."

157. For an *Improvement in Folding Umbrellas;* Henry Richardson, Sheldon Morris, Jr., and Bennet C. Perry, Litchfield, Connecticut.

Claim.—"We claim, 1st, The combination of the spring and its hook or catch with the hinge, the said spring being secured to one part of the hinge or rib, and the hook or catch taking into a notch in the other part of the hinge or rib, when the two parts of the rib are in line, for the purpose of making the joint rigid. 2d, Attaching the several joints or parts of the stick together, by means of a link which is connected to the end of the male screw, and has a ring, or equivalent, fitting in a hollow part behind or within the nut, which prevents its passing through the nut, but which at the same time allows the screw to turn freely within the nut."

158. For an *Improved Instrument for Manufacturing Door Knobs;* Artemas Rogers, Painesville, Ohio.

Claim.—"I claim the instrument, or its equivalent, by the use of which I am enabled, with one and the same instrument in continuous use, to form the screw threads or other impressions within the socket of a door knob, remove the knob from the mould to the polishing furnace, manipulate it during the fire, polishing, and finally deposit it in the annealing kiln."

159. For an *Improved Pavement Washer, Hose Hydrant, and Hitching Post;* Charles M. Alburger, Philadelphia.

Claim.—"I claim, 1st, Making a double waste cock by cutting the two waste notches, or their equivalents, in the plug of the cock, so that either notch may be put in communication with the usual waste holes in the barrel, by turning the plug in either direction, when the said double waste cock is used, in combination with a pavement washer, hose hydrant, or other hydraulic apparatus requiring the water in the outlet pipe above to waste in the ground below when the reservoir pressure is shut off by turning the plug of the cock; and, 2d, The general arrangement and combination of a pavement washer, hose hydrant, and hitching post."

160. For an *Improvement in Manufacturing Two Ply Carpets;* Thomas Crossley, Boston, Massachusetts; ante-dated February 22d, 1854.

Claim.—"I do not claim the manufacture of carpets composed of different fibrous materials, in which the whole or nearly all of one fibre is shown on one side of the carpet, and all or nearly all of the other fibre on the other side of the carpet, as this has been done in pile carpets and other fabrics; but I claim as a new article of manufacture, a two ply ingrain carpet, having the lower ply composed entirely of linen or cotton, and the upper ply of wool, when united, in the manner described, for the purpose of producing a durable and economical carpet, to be subsequently printed upon one side, in the manner described."

161. For an *Improved Daguerreotype Plate Holder;* Joseph Hill, Skaneateles, N. Y.

Claim.—"I claim the application of the inward pressure by means of the springs, by their force retaining the daguerreotype plates to the block by the contact of the daguerreotype plates, with the plates on the edges of the block. It is understood that the daguerreotype plates may be confined by their ends as well as sides; by the same principle, blocks may be made of any substance."

162. For an *Improvement in Tuning Forks;* Joseph C. Jinkins, Bealsville, Ohio.

Claim.—"I claim producing sounds of any required pitch with a single tuning fork, by means of a movable cross bar inserted in the proper positions between the prongs of the fork."

163. For an *Improved Means for Preventing the Explosion of Boilers;* A. W. Jones, City of New York.

Claim.—"I am aware that contrivances have been made by which the valve, which is raised by the pressure of steam, is made to open another valve for its escape from the boiler; and I therefore do not claim to have been the first to have made such a discovery; I claim the combination of the rock shaft with the slide valve, piston, spring valve, and steam chest, in the manner described."

164. For a *Machine for Sawing Clap Boards, &c.;* D. F. Mellen, Wentworth, N. H.

Claim.—"I do not claim two saws operating simultaneously upon opposite sides of the same piece of lumber; but I do claim the arrangement of devices by which the distance between the saws is varied to meet the varying thickness of the logs to be sawed, and the saws, when so adjusted, are elevated and depressed together, as required. I claim the method of feeding the log between each successive cut of the saws; that is to say, causing the feeding pawl, or the lever which carries it, to strike against a fixed stop, in combination with the yielding dog. I claim the method of raising and lowering the saws, when it is desired not to use them at the same time, but alternately, during the forward and backward motion of the log, the same being effected by the combination of the unlocking, shifting, and locking apparatus, in combination with the lever and chains, the whole operating in the manner set forth."

165. For *Improved Saw Set;* William O. Rust, Great Falls, New Hampshire.

Claim.—"I claim the rotary bender and its adjusting screw, in their combination with the movable lever. Also, the arrangement of the regulating back stop on the stationary arm, so that it may be used in connexion with the movable lever."

166. For an *Improvement in Securing Glasses in Lanterns;* H. Sangster, Buffalo, N.Y.

Claim.—"I claim the combination of the springs and the frame, arranged and operating substantially as set forth, not intending to claim the springs uncombined with the frame, or some device equivalent thereto."

167. For an *Improvement in Sewing Machines;* E. Shaw, East Abington, Mass.

Claim.—"I claim, 1st, The combination of the rack bar with the bar, both curved in the same shape, and forming a clamp capable of receiving a vibrating motion from the diamond shaped teeth of the pinion, and constituting a clamp for sewing the seams of boot legs. 2d, I claim feeding the clamp along, and guiding it so as to keep the leather to be sewed always in proper position with regard to the needle, and at the same distance from the same, by means of the rack gear, with its diamond shaped teeth, and proper guides."

168. For an *Improved Carpenter's Gauge;* Halcyon Skinner and Wm. Greenhalgh, West Farms, New York.

Claim.—"We claim the combination of the frame with the adjustable sliding bars, adjustable fences, and set screws, in the manner described."

169. For an *Improvement in Harness Saddle Trees;* Robert Spencer, Southport, Conn.

Claim—"I do not claim constructing the frame and cantel of a harness tree, in separate pieces, nor the insertion of leather between them; but I do claim harness saddle tree, constructed of combined iron and leather, or the equivalent of leather, the iron serving the purpose of a skeleton, and giving it the proper rigidity, while, by trimming the leather portions of the tree, the exact conformation is attained."

170. For a *Catamenial Supporter;* Alfred A. Starr, City of New York.

Claim.—"I claim the combination of the elastic spring, in the manner set forth."

171. For *Improvement in Fastenings of Ploughs;* David Swartz and Samuel Swartz, Toms' Brook, Virginia.

Claim.—"We do not claim constructing the point and cutter in separate pieces, so as to be attached and detached at pleasure, but we do claim constructing the mould board and land side with slots, as described, and the point and cutter with the tongues and flanches to fit the said slats, so that the said point and cutter shall slide in horizontally, or nearly so, and form a fastening with the mould board and land side, without the use of screws or bolts."

172. For an *Improvement in Harness Saddles;* Robert Spencer, City of New York.

Claim.—"I claim a properly shaped harness saddle seat, cast in one piece, with the unfinished jockey shaped side bars; the said seat requiring to be only smoothed and japanned to adapt it to use, and the said side bars requiring to be covered with patent leather or jockeys, or skirts of sufficient thickness to make a smooth and harmonious finish with the japanned surface of the seat."

173. For an *Improvement in Counting Machines;* Paul Stillman, City of New York.

Claim.—"I claim the employment and arrangement of the clutches, having a spring sideways, so as to catch into the face notches, and the styles outside the count wheels, by which they are operated, to move a series of count wheels, in the manner set forth."

174. For an *Improvement in Ovens;* Francis C. Treadwell, Jr., City of New York.

Claim.—"I claim the use of the combination of the furnace, flues, and dampers, in combination with an endless band running through the oven, and over drums placed outside of it, for the purpose of making a perpetual baking oven."

175. For an *Improvement in Track Clearers to Grass Harvesters;* Abner Whiteley, Springfield, Massachusetts.

Claim.—"I claim the rolling cone moving on the axis, and furnished with a joint clearer, for the purpose of clearing a track in the cut grass."

176. For an *Improvement in Cheese Presses;* Philander Wilber, Milan, Ohio.

Claim.—"I claim the combination of the two rack slides with the respective attachments of the cam and friction roller, by which means, in connexion with the slides and accompanying racks, the press is operated."

177. For *Improvements in Clamps for Sewing Machines;* Melvin Shaw, Assignor to Melvin Shaw and Daniel G. Wheeler, East Abington, Massachusetts; ante-dated February 22d, 1854.

Claim.—"I claim the combination of the sliding bar with the curved clamp and the rest, constructed and operating together, in the manner substantially as set forth, by which means, as the work is fed through the machine, it is kept constantly up to the needle, and the stitches are placed at a uniform and unvarying distance from the edges of the material, without dependence upon the care or skill of the workman."

178. For an *Improved Machine for Planing Lumber, out of Wind;* Solomon S. Gray, Assignor to S. S. Gray and S. A. Woods, South Boston, Massachusetts.

Claim.—"I claim, 1st, The peculiar construction of cutter head herein described, the cutter head itself being made use of to turn and break the shaving, in the manner of a double iron plane, and being furthermore made concave, for the purpose of facilitating this operation. 2d, I claim the clamp for the purpose of dogging the lumber to the bed of the machine, the body of the clamp being pivoted, and forced up by the screw, or its equivalent, the dogs being adjustable therein, in the manner set forth. 3d, I claim the method of securing the dog to the bed of the machine by means of the teeth or cogs, and the mortises in the side pieces."

179. For an *Improvement in Operating Dampers of Furnaces;* Daniel Treadwell, Cambridge, Assignor to Herbert H. and Frederick H. Stimpson, Boston, Mass.

Claim.—"I claim using the expansion of the stove or furnace for closing the damper, through the medium of the devices described, or any other combination of devices substantially similar."

180. For an *Improvement in Furnaces for Making Wrought Iron directly from the Ore;* Thomas W. Harvey's (now dec'd., late of the City of New York,) Administrators, Assignors to the Harvey Steel and Iron Company, City of New York.

Claim.—"I claim causing the de-oxydating and de-sulphureting flames and gases, generated in the furnace, to act directly in contact with properly prepared ores of iron (and other metals,) placed upon suitably arranged tables, while, at the same time, a high degree of heat is imparted to the under sides of said tables."

181. For an *Improvement in Cog Gearing;* James A. Bazin, Canton, Assignor to Alfred B. Ely, Boston, Massachusetts.

Claim.—"I claim the manner of manufacturing cog wheels, every alternate tooth being bent in opposite directions from the plane of the plate, in the manner described."

182. For an *Improved Tool Rest for Turning Lathes;* M. H. Merriam, Chelsea, and W. W. Nichols, Assignors to W. W. Nichols & Co., Boston, Massachusetts.

Claim.—"We claim the combination of the elevating screw with the nut and tool post and slide, in which, by turning the nut, you can elevate the tool post and the elevating screw, and, at the same time, the elevating screw is prevented from turning by the

gibs. Also, the groove in the slide, by which the tool post, elevating screw, and nut, are prevented from rising, by pins, or their equivalent, fitted into the nut and running in the groove when the nut is not turned, but when the nut is turned, the tool post can be lowered. We claim the gibs and the elevating screw, as combined with and running in the channels of the slide, by which a vertical movement of the elevating screw is produced, and a rotary prevented."

183. For an *Improved Tool for Boring Recesses for Casters, &c.;* Benjamin F. Graves, Assignor to Wm. C. Knowlton, Boston, Massachusetts.

Claim.—"I do not claim the combining the throat of a chisel with the discharging chip groove of the twist auger, or making the latter to enter directly into the former, whereby its chips are not only discharged through the said throat, but by the pressure exerted on them by the spiral form of the groove of the auger, they are made to aid in the discharge of the other chips from the throat, and thereby prevent the choking of the chips in the throat; but I claim the combination and arrangement of the twist auger, the two cutters or chisels and their throats on the block, so as to operate together and simultaneously, and make a chamber or recess in a piece of wood, of the form substantially as specified. Not meaning to claim a single cutter and a twist auger, as applied to a shaft, so as to merely bore two cylindrical recesses."

184. For an *Improvement in Sewing Machines;* Sidney S. Turner, Westboro,' Assignor to Elmer Townsend, Boston, Massachusetts.

Claim.—"I claim the arrangement of a hook or hook needle underneath, and so as to work up through the feeding bar, in combination with the arrangement of the presser above the fèeding bar, and so as to press downwards towards it, substantially in the manner as described, such enabling me to obtain an important advantage in operating by the single chain stitch sewing machine. And, in combination with the mechanism for giving the vertical movements to the needle, the slot, and the screw or pin, (or mechanical equivalents therefor,) for producing reciprocating semi-rotative movements of the needle during the vertical movement of it, substantially as described."

185. For an *Improvement in Machines for Casting Metallic Eyes or Mail of Heddles for Looms;* Jacob Senneff, Philadelphia, Pennsylvania.

Claim.—"I claim, 1st, The method of casting the eyes or mails on the strands of yarn, or other material, by inserting the yarns successively within a mould secured on a vibrating frame operated at the proper intervals of time, by means of the eccentric cams, said mould being opened at times to disengage the mail therefrom, and provided with a core for forming the eye in the mail, and capable of being withdrawn therefrom before the mould opens. 2d, I claim the manner of operating the core so as to enable it to be so withdrawn from the eye of the mail after the same is formed, and whilst it is firmly embraced within the mould by means of the spring and screws, operating in the manner described. 3d, I claim the core carrier, resting in a notch formed in the top of the spring, and having pins on its face which pass through slots in the mould plates and spring for moving the core horizontally from the stationary half of the mould, and keeping it midway between the mould plates, when they are opened by the lever, and preventing it being thrown violently either way. 4th, I claim the manner of operating the heddle frame holder, by means of the eccentric cams on the shaft, capable of being moved longitudinally over the grooves in said shaft, right angled levers to which the heddle frame is secured, and spiral springs for keeping the ends of the levers always in contact with the eccentric cams; and, in combination therewith, I claim the screw shaft and clamps, and the adjustable gearing at the ends of the screw and main driving shafts."

186. For an *Improvement in Machines for Rolling Shoulders on Axles;* Wm. Van Anden, Poughkeepsie, New York.

Claim.—"I claim the arrangement of the cam rollers, having the reduced surfaces with the guide and feeding tube or box, through the hollow space of which I am enabled to put in the blank bar of iron, and withdraw the finished axle without displacing the forming rollers, or cams, or feeding tube, or box."

187. For an *Improved Steam Valve;* Robert Ross, Philadelphia, Pennsylvania.

Claim.—"I claim the mode of constructing the valve, the same consisting in the loose or detached valve and stem or guide, and combined with the hollow valve rod."

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188. For an *Improvement in Hog Pens;* R. M. Abbe, Thompsonville, Connecticut.

Claim.—"I claim the swinging guard of the pen, in the manner described."

189. For an *Improvement in Cultivators;* W. T. Bazemore, County of Bibb, Georgia.

Claim.—"I claim the form of the hoes, and the arrangement of the rods, by which the hoes are made adjustable, and yet may be held stationary."

190. For an *Improvement in Washing Machines;* Wm. Biddle, LaFayette, Indiana.

Claim.—"I claim the combination of the vibrating bar and vibrating wash board with the lever, the vibrating wash board having its jointed attachment nearer to the centre of motion of the lever than the bar, so that in the motion of the lever back and forth, the clothes shall be griped and released."

191. For an *Improvement in Maize Harvesters;* G. A. Bruce, Mechanicsburgh, Ill.

Claim.—"I claim the combination and arrangement of the oblique revolving cutters, revolving inclined directing shafts, bending and holding arms, and inclined guides."

192. For an *Improvement in Spirit Levels;* Lebbeus Brooks, Great Falls, N. H.

Claim.—"I do not claim the combination of a circular divided limb or plate and a spirit level with a bar or beam; but I claim the combination therewith of an index bar, its divided sectoral arc or limb, and its locking plate and spring catch, or the mechanical equivalents for such locking plate and catch."

193. For an *Improved Window Blind Holder;* E. W. Bullard, Hardwick, Mass.

Claim.—"I claim a blind fastener, consisting of the swivel box, with its projection or hasp, turning freely upon, and when the blind is opened or closed, rigidly held by, the angular rod, the said rod having a bearing upon which it swings in the projecting plates."

194. For an *Improvement in Fastening Skirts to Saddle Trees;* Julius C. Dickey, Sandy Hill, New York.

Claim.—"I claim the combination of the teeth upon the elastic clamp plate, by which means it is held immovable in its position upon the leather, with one or more screws, or their equivalent, to draw the spring clamp plate and jockey plate together, for fastening the skirt to the saddle tree, whether the jockey plate be adjustable, or otherwise."

195. For a *Stave Machine;* Isaac B. Dudrey, Athens, Ohio.

Claim.—"I claim the mode of sawing logs or blocks both ways, by means of two circular saws, so arranged and operated that the saws shall cut alternately in opposite directions by being carried to and from the log or block as it moves back and forth, using therefor any well known mechanical means for effecting the same."

196. For an *Improved Stave Machine;* Isaac B. Dudrey, Athens, Ohio.

Claim.—"I claim the employment of two knives within the curved jaws of a vibrating cutter head for cutting the staves both ways, that is, in the back and forth motion of the cutter head, and in combination therewith, I claim the curved guides or guards for holding the stave when the same has passed the feed rollers."

197. For an *Improvement in Ploughs;* O. G. Ewings, Heart Prairie, Wisconsin.

Claim.—"I claim the jointed beam, in combination with the adjusting screws."

198. For an *Improvement in Manure and Lime Spreaders;* Joseph W. Fawkes, Christiana, Pennsylvania.

Claim.—"I claim constructing the hopper with a swing diaphragm or dividing board, by which the material intended for spreading is prevented from arching. Also, the arrangement and combination of the moving breakers or pulverizers (actuated by the device, as described,) with the rollers, for the more effectual distribution of the contents of the hopper."

199. For an *Improved Method of Guiding Cross-Cut Saws;* Richard Fanning, Clarksfield, Ohio.

Claim.—"I claim, 1st, The hanging of the saw frame in the sash beam by means of a vertical slot, the curvilinear slot and the guides, so that a backward and forward movement of the saw in a direct line is effected, in combination with a rocking movement of

the same. 2d, The combination of the hand lever with the sash beam, for the purpose of regulating, at pleasure, the feed of the saw. 3d, The arrangement of the sash beam so as to be elevated or depressed by turning on the pivot or journal, in combination with the movable frame sliding in the grooves, for the purpose of rendering the saw adjustable to and capable of operating upon logs, or timber of any dimensions, and in various positions, while, at the same time, the movement of the saw is always kept in a line with the direction of the pitman, whatever may be the size or position of the timber to be cut."

200. For an *Improvement in Leather Splitting Machines;* Joseph F. Flanders and Jeremiah A. Marden, Newburyport, Massachusetts.

Claim.—" We claim the use of the continuously revolving or endless belt knife, as applied to machines for splitting leather."

201. For an *Improvement in Bedsteads for Invalids;* J. T. Forbes, Coburg, Canada West; patented in Canada, February 2, 1834.

Claim.—" I claim, in combination with the arrangement of the said shaft, gear and rock shafts, the rock shaft with its attachments, by which the invalid can move the head and foot boards himself."

202. For an *Improvement in Cast Hinges;* Nelson Gates, Cincinnati, Ohio.

Claim.—" I claim the employment, within any number of joints in the knuckle of a hinge, of several metal washers, which are of concavo-convex, or other form, which renders them capable, without any assistance, of serving as a pivot or centre of the hinge."

203. For an *Improvement in Slide Valves for Steam Engines;* John Gleason, Northfield, Vermont.

Claim.—" I claim, 1st, The valve, constructed in combination with the cavities in the covering plate and the enlargement of the steam ports. 2d, In combination with the cavities in the covering plate and the passages in the valve, I claim the safety valves placed on the top plate, for the purpose of allowing the steam to escape from the cylinder into the steam chest, when the pressure in the former exceeds that in the latter."

204. For an *Improvement in the Manufacture of India Rubber;* Dan. Hayward, Providence, Rhode Island.

Claim.—" I claim the improvement in the process of vulcanizing native india rubber, or rubber once vulcanized compounded with other articles, which consists in heating and curing them with steam and under pressure, and in regulating the application of steam and the induration of the product by the introduction of steam and water."

205. For an *Improvement in Seed Planters;* S. M. Hockman, Toms' Brook, Virginia.

Claim.—"I claim the inclined traversing or agitated screen, or its equivalent, to separate the refuse or other matter which is too large to pass through the openings which graduate the quantity spread upon the ground, and thereby prevent such openings from becoming choked. I am aware that radial scores on a plane surface are described and represented in Francis Van Doren's patent of the 13th of April, 1852, which I do not claim; but what I do claim is, making radial scores on a somewhat convex surface, so as to distribute the grain and manure more uniformly."

206. For an *Improvement in Manure Excavators;* A. R. Hurst, Harrisburgh, Pa.

Claim.—" I claim the combination and arrangement of the swinging toothed cross bar, carriage, and swinging stop bar, so as to form an implement for excavating or loosening and separating the particles of manure with ease and facility."

207. For an *Improvement in Seed Planters;* John H. King, Jr., Georgetown, D. C.

Claim.—"I do not claim solid scatterers, such as are used in the lime spreader of J. Hatch, patented August 17, 1835, and also shown in the rejected application of M. D. Wells; neither do I lay any claim to the use of sieves or screens above the hopper; but what I claim is, the employment of the adjustable scatterer, as described, for insuring the even distribution of the various seed and manures passed through the apparatus."

208. For an *Improvement in Lamp Fillers;* C. R. Landmann, City of New York.

Claim.—" I claim the use of the safety filling apparatus, in combination with a filler case."

209. For an *Improvement in Dies for Making Augers;* Ezra L'Hommedieu, Chester, Connecticut.

Claim.—"I claim the peculiar arrangement of the shank entrance of the matrix, that face of it against which the hollow surface of the auger head rests and is formed, and the male die which forms the hollow or recess of the head, the same enabling me to make an auger head not only with the whole of its recess stamped or formed by dies, but having its shank at the proper turning angle with respect to it."

210. For an *Improvement in Harrows;* J. G. McCauley, Stone Bridge, Virginia.

Claim.—"I claim the constructing the double tooth so that one portion may operate on the ground, and the other be in reserve, and also serve as a shank to confine the tooth to the beam, in connexion with the band and key."

211. For an *Improvement in Binding Folder;* John B. Nichols, Lynn, Mass.

Claim.—"I claim the binding folder, (made to guide and fold,) whether used in connexion with a sewing machine or with any other mode of fastening the binding after it is folded and applied."

212. For an *Improvement in Ploughs for Planting Potatoes;* Whitman Price, Goldsborough, North Carolina.

Claim.—"I claim the particular form of skimmer plate, in combination with mould boards, tree, and shovel."

213. For an *Improvement in Seed Planters;* Wm. Redick, Uniontown, Pennsylvania.

Claim.—"I claim the specific arrangement of the cams on the axle, the markers on the periphery of the carrying wheel, and the valves at or near the bottoms of the seeding tubes, with their several operative parts, for the purpose of causing regularity in the marking and dropping of the grain, regardless of the varied speed of the horses drawing the machine."

214. For *Improved Saw Mill Dogs;* Titus H. Russell, Taftsville, Vermont.

Claim.—"I claim the device to keep the hinges of the dogs tight, and thereby more effectually maintain the straightness of the saw kerfs, and uniformity in the thickness of the lumber. Also, the construction of the slide which carries the dog of the head block with a broad platform to support the dog firmly against lateral pressure, and a long narrow arm to extend back of the saw race to the opposite end of the block, the wide and narrow portions of the slide moving on parallel guide rails of corresponding width, whereby the dog, while necessarily limited to a short support on that end of the head block on which it rests, is by this supplementary slide arm seated as firmly on the block as if its slide could be made to extend across the saw race, thus avoiding the binding and other difficulties which have heretofore existed for want of length and firmness in the sliding dogs of the head blocks."

215. For an *Improved Method of Tenoning Spokes;* R. L. Sibbet, Shippensburgh, Pa.

Claim.—"I claim securing a series of spokes upon a board or plate provided with ledges or projections, adjustable gauge block, guide strip, cross piece, cross bar, and block."

216. For an *Improvement in Corn Shellers;* Andrew J. Smith, Piqua, Ohio.

Claim.—"I claim the yielding guard board, having its rear edge somewhat elevated and hinged to the frame, and resting by its front edge upon the rear portion of the shaking continuous carrier, so as constantly to fill the varying interval between the said carrier and the shelling concave."

217. For a *Puppet Valve for Hydraulic Rams;* Joseph C. Strode, West Chester, Pa.

Claim.—"I claim the construction of puppet valves of hydraulic rams with the upper part of the valve sliding in contact with the sides of the valve chamber, and the part made conical or tapering."

218. For an *Improvement in Chairs for Exercising;* J. Stevens, Chicopee Falls, Mass.

Claim.—"I claim a nursery chair for exercising, amusing, and weighing young children, having its parts arranged as described."

219. For an *Improvement in Breast Cups;* Elisha Waters, Troy, New York.

Claim.—"I claim connecting the chamber of the diaphragm pump with the breast cup, by means of the curved exhaust tube, by which the said breast cup can be nearly filled with milk from the breast, without allowing any portion of its contents to flow into the chamber of the pump, which prevents the necessity of frequently removing the cup from the breast whilst using the instrument. Also, the arrangement of the said breast cup and curved exhaust tube with the within described diaphragm pump, by which the patient is enabled to use the instrument without the aid of an assistant."

220. For an *Improved Horse Shoeing Apparatus;* Noah Warlick, La Fayette, Ala.

Claim.—"I claim the head piece, with the adjustable slide, for adapting the apparatus to hoofs of every size."

221. For an *Improved Machine for Cutting Tenons;* Charles P. S. Wardwell, Lake Village, New Hampshire.

Claim.—"I claim the manner of combining and arranging the squaring off saw, vertical shoulder saws, and horizontal tenon saws, or horizontal saws and cutters combined, so as to constitute a machine which is capable of completing the tenon or tenons before the rail is discharged. 2d, The manner of combining and arranging the saw arbor, swinging frame, slotted segment, lever and set screw, for the purpose of facilitating the operation of adjusting the shoulder saws or tenoning saws. 3d, The employment of one or more cutters between the horizontal tenon saws, in combination with the shoulder saws, for the purpose of cutting two or more tenons on each of the rail at one operation."

222. For an *Improved Hydraulic Ram;* Joseph D. West, City of New York.

Claim.—"I claim having two valves placed at the ends of a rod, the valves being fitted at the ends of passages which are connected by branch pipes to a main pipe leading from the spring or source."

223. For an *Improvement in Counter Twist Speeders;* J. Whitehead, Manchester, Va.

Claim.—"I claim the combination of the upper bobbin shaft with the curved overlapping bobbin bars."

224. For an *Improvement in Nail Machines;* John Woolton, Boonton, New Jersey.

Claim.—"I claim the two pairs of segmental rolls, combined so that the first pair brings the nail or spike nearly or quite to the desired form, and the second may complete it, and by their reversed position finish off the finned, feathered, or ragged corners which were formed by the junction of the former rolls."

225. For an *Improved Governor for Wind Mills;* Daniel Halladay, Ellington, Conn.

Claim.—"I claim attaching the spindles of the wings or sails to a sliding head, by means of the levers, or their equivalents, and operating said head by means of the lever, or its equivalent, and a governor of any proper construction, for the purpose of giving the desired obliquity to the wings or sails, and thereby insuring an equal motion of power during the variable velocity of the wind."

226. For a *Method of Furling and Unfurling Wind Mill Sails;* Thomas C. Vice, Rochester, New York.

Claim.—"I claim the clothing and unclothing of wind mills whilst the vanes thereof are in motion or at rest, by means of an iron rod passing through the main hollow vane shaft, in connexion with a bevel gear and pinions attached to their respective rollers, to which rollers are fastened reefing lines connected with the sails."

227. For an *Improvement in Sewing Machines;* Sidney S. Turner, Westborough, Assignor to Elmer Townsend, Boston, Massachusetts.

Claim.—"I claim constructing the feeding wheel in the form of a toothed annulus or ring gear, or the equivalent thereof, and connecting it with the feeding shaft, by a universal joint or ring, and two sets of journals applied together, whereby the cloth or material to be sewed can be readily turned in any direction without the necessity of lifting the presser or presser wheel, as would be required in the performance of such an operation on various sewing machines."

228. For an *Improvement in Glass Lanterns;* Philemore A. Morley, Assignor to James Bright, Brooklyn, New York.

Claim.—"I claim a lamp and lantern of any desired configuration, when made of glass, and in one piece, as described."

229. For an *Improvement in Lard Lamps;* Dexter H. Chamberlain, Boston, Mass., Assignor to Wm. R. Meshurul, New Haven, Connecticut.

Claim.—"I claim the lamp for burning lard or concrete fatty matters, made with an arrangement of the wick tubes, the lard reservoir, and the supporting bifurcated stand, as described, and with the reservoir applied to the stand so as to turn on centres and be fastened in position under any inclination or elevation of the wick tubes."

230. For a *Machine for Dressing Ship Timber;* James E. Crowell, Assignor to self, Edmund Smith, and Charles T. Stickney, Salem, Massachusetts.

Claim.—"I claim the mode of supporting and guiding the movable carriage which carries the lumber that is to be dressed, such consisting in employing four movable rails, arranged and applied together and made adjustable, so as to make the carriage, during its longitudinal movements, not only have a transverse dipping movement, but also a longitudinal dipping movement, or such movements as will enable it to present to the cutter wheels in a proper manner the waved surface to be dressed."

231. For a *Multiform Moulding Plane;* Thomas Worrall, Assignor to Mifflin Paul, Mount Holly, New Jersey.

Claim.—"I claim the slide attached to a plane by means of plates and screws, which will make that plane capable of working all kinds of grooves, fillester, and mouldings."

Additional Improvement.

1. For an *Improvement in Harness Saddle Trees;* Thomas Mardock and William C. Kellar, Cincinnati, Ohio; dated Aug. 1, 1854; additional patent dated Oct. 12, 1852.

Claim.—"We claim the construction of harness saddle trees with the loose cantle, in combination with the crupper loop, or its equivalent."

Re-Issues for August, 1854.

1. For *Cut Nail from Muntz' Metal;* Samuel L. Crocker, Taunton, Massachusetts; ante-dated August 1, 1854; originally dated April 17, 1849.

Claim.—"I claim a yellow metal nail or spike, made by cutting and heading it in a nail or spike machine, meaning by the term yellow metal, a metal composed of copper and zinc, in the proportions in which they are usually combined in the manufacture of the well known Muntz' sheathing metal."

2. For a *Gold Amalgamator;* William Ball, Chicopee, Massachusetts; dated August 8, 1854; originally dated September 9, 1851.

Claim.—"I claim the combination of the partition (dipping below the surface of the water,) with the lower distributor, provided at the centre with a discharge aperture for the water and light particles, and at the periphery with apertures for the discharge of the water and heavier particles, for the purpose of preventing the escape of gold over the central or waste pipe. Also, the arrangement of the sliding tube ferrule or waste gate directly upon the hollow axle of the lower distributor, the same being for the purpose of regulating the head of water within the said distributor. I am aware that it is not unusual in gold washers to use a succession of baths; therefore, I do not claim such arrangement in general; but I claim arranging the secondary mercury bath, concentric with and below the primary one, in such a manner that the current of water, et cetera, return towards the centre of the apparatus, thereby saving room and causing said currents to pass more slowly. Also, rubbing the pulverized ore into the mercury, in the manner described."

3. For *Improvements in Bank Locks;* A. C. Harig and D. C. Story, Louisville, Ky.; August 22, 1854; originally dated July 25, 1854.

Claim.—"We claim connecting the series of male tumblers with the vibrating portion

of the bolt, in such a manner that all of said tumblers must vibrate with said portion of the bolt, and said portion of the bolt must vibrate with said series of tumblers, whilst any one of said tumblers may be moved endwise independently of said vibrating portion of the bolt, and vice versa, by which they are enabled to be operated in connexion with a series of entirely independent stationary female tumblers that can be adjusted in different positions. 2d, The series of female tumblers, when they are secured in such a manner to the lock case that while they admit of unlimited adjustment to suit the different positions into which any key can be made to throw the series of male tumblers, they are so arranged as to be independent of the longitudinal movements of said male tumblers, or the bolt which is combined with them, and consequently are perfectly protected from injury or disarrangement by said movements, and also from any violence that may be exerted upon the bolt. 3d, In connexion with the said series of male tumblers and the vibrating portion of the belt, arranged and combined in such a manner that they must vibrate with each other, and can be moved lengthwise, independently of each other, we claim the fixed and strongly secured studs, arranged in such positions that the bolt cannot be shot back until the vibrating portion thereof is brought up to the highest point allowed by the matching of the series of male tumblers, with which it is combined with the series of female tumblers that are combined with the lock case, by which, when the bolt is shot out, both series of tumblers are perfectly protected from injury by any violence exerted upon the bolt. 4th, We claim the self-adjusting guard, arranged and operating in the 'usher,' in such a manner that the introduction of powder or picking instruments into the lock through the key hole, is effectually prevented. 5th, We also claim the arrangement of the inclined notch on the 'usher,' with the dog and the bolt moving cam, by which the act of turning the usher to enable the key which it carries to operate the tumblers, will throw the dog into such a position as to prevent the said cam from being brought in contact with the vibrating portion of the bolt during the time said 'usher' is being moved, by which the possibility of laterally 'feeling' the positions of the tumblers whilst the key (or a substitute therefor) is in moving contact with them, is entirely prevented."

Designs for August, 1854.

1. For a *Cooking Stove;* Wm. M. Snow, Providence, R. Island; dated Aug. 8, 1854.

Claim.—" I claim the design for the side plate of a cooking stove."

2. For *Cooking Stoves;* Samuel H. Sailor, Assignor to Abbott & Lawrence, Philadelphia, Pennsylvania; dated August 8, 1854.

Claim.—" I claim the design and arrangement of the ornaments in bas-relief and mouldings on the several plates, for stoves called 'Champion Cook.' "

3. For *Franklin Stoves;* John F. Allen and Joseph Stewart, Assignors to Jas. G. Abbott and A. Lawrence, Philadelphia, Pennsylvania; dated August 8, 1854.

Claim.—" We claim the design of the several ornaments in bas-relief and mouldings on the plates and foot of the stove."

4. For *Cooking Store;* F. Keller and Elias Young, Cincinnati, O.; dated Aug. 15, 1854.

Claim.—" We claim the general form and proportions combined with the mouldings, figures, and ornaments, as described, the said figures, ornaments, and panels, being in alto, in mezzo, or in bas-relief."

5. For *Fronts of Clock Cases;* Nicholas Muller, City of N. Y.; dated Aug. 29, 1854.

Claim.—" I claim the composition of ornamental work."

6. For *Cooking Stoves;* Amos Paul, Newmarket, N. H.; dated Aug. 29, 1854.

Claim.—" I claim the ornamental configuration for the side and front plates of a cooking stove."

MECHANICS, PHYSICS, AND CHEMISTRY.

For the Journal of the Franklin Institute.

Thoughts on the Caloric Engine. By Thomas Ewbank, Esq.

(Continued from page 285.)

Different opinions may prevail respecting the value of the regenerator as an economizer of heat; there can be but one about this extra and unproductive consumption of the motive fluid. Without a regenerator, the whole charge of the feed pump may be delivered in the expanding chamber, but with it a quantity of air equal to its capacity, is kept back at each stroke of the feed pump from the heating surface or furnace.

If the regenerator compressed air into a smaller volume by heating it, (an impossibility,) it might be what it is claimed to be; or if, like waste steam applied to heat feed water, it did not sensibly alter the volume, it would have some of the virtue ascribed to it. And here we may remark that, its kindred device for applying waste steam is useful, because it does not anticipate expansion of the feed water. This does not take place till the liquid reaches the chamber of expansion. Suppose the waste heat of a steam engine *all* saved, and that it dilated the feed water into steam; what then? Why, as no expansion would then be effected in the boiler, the steam engine, like the caloric one under similar circumstances, would stand stock still. Instead of exchanging watery vapor for water, it would receive the same thin material it gave out. The engine would have no capital to work on. The operation would be the same as passing money out of one hand into the other. Thus, in the steam as in the caloric engine, the effect of expanding the motive fluid before it enters the place of expansion, is injurious in proportion to the expansion, and fatal when fully carried out.

The disputes maintained about the value of the regenerator, in American and foreign Journals, will never put the matter at rest. Let the proper demonstrator, experiment, be called in. Let a disinterested party work the large model engine in New York, to the limits of its power *with* the regenerator, and then under precisely the same circumstances *without* it. The margin of alleged profits is so wide that the truth, more or less clear and potent, must appear at once. Why an experimentum crucis of the kind has not been submitted to and even courted, we do not understand, since it is the quickest, surest, and only mode of definitely determining the value of the caloric engine. Why theorize, argue and quarrel for months about the weight of a piece of metal, when the scales are at your elbows?

Like other important problems in mechanical science, this one of force repeating itself by means of heat, might be solved in the laboratory of one of our public institutions, and with simple apparatus.

P. S. It is claimed for the caloric engine, that it is legibly endorsed by nature. One or two more passages from Sargent will show Captain Ericsson's peculiar views of and deductions from natural forces. We know that with some gentlemen, nothing more was wanting, after this

publication, to convince them that the true question was, "will nature turn aside from her own path, and enter the one into which the author of the caloric engine invites her?"

"The prescribed limits of a lecture like the present, will not permit me to follow the deeply interesting analogies, traced by Ericsson, between the principle of the caloric engine, and that of animate and terrestrial force. Some of his views and calculations on the subject, however, I cannot omit to present to this audience, chiefly to meet the objections of those who imagine that they can detect, in the caloric engine, principles that involve the chimera of the perpetual motion.

"The sophist accounts for the continued reproduction of the forces expended in nature, by what he calls a nice balance. If this expression fail to convey a distinct idea to those who hear it, it is probably because no very distinct idea on the subject exists in the mind of him who employs it. He imagines that all force exerted in nature is productive of an equivalent counter force; but how nature makes this counter force subservient, he cannot explain. Were his doctrine true, the principle of the caloric engine would very much resemble that of the perpetual motion; for its object is the production of a continual force almost without reference to the amount of the original exciting cause. Surprising as this may appear, the truth of it is manifested by the principal operating forces in nature, nearly the whole of which, as Ericsson contends, in a strictly mechanical view, are wasted, or, in other words, are exerted without producing any useful or available counter effect. And yet nature has ever at her command an unlimited amount of force.

"To illustrate the amount of this force, I will present one or two calculations by Ericsson, that may excite the astonishment of all who have not had their attention particularly directed to this subject."

He then refers to the force of running streams; instances the fall of water at Niagara, as equalling the power of 15 millions of horses, which may be multiplied hundreds of times by other rivers, and observes that this stupendous force is kept up without any observable decay in itself or in its source, while, to obtain an equal amount by steam, would consume three hundred millions of tons of coal annually.

"By keeping up a force equivalent to a few millions of horse power in our steam engines, we are fast exhausting our mineral store houses; while nature, in constantly exerting a force a million of times greater, causes no change any where that is perceptible to the most rigid scrutiny. Here, then, we have a caloric engine on a vast scale, and a *regenerator* that is susceptible of no improvement.

"The forces to which I have hitherto alluded, many will ascribe to solar influence; a term by which they merely assign a remote location to the acting cause, but fail to explain it. To meet this class of reasoners, Ericsson has prepared another calculation, based upon those forces in *animate* nature, for the production of which solar influence is not absolutely necessary. This calculation estimates the amount of force constantly exerted by animate nature, as equivalent to that of an engine of 100,000,000 of horses power. * * * Hence, it follows that, with *our* present imperfect means of producing mechanical power, we should require *two thousand millions* of tons annually, to exert a force equal to that of animate nature. And yet animate nature perpeually maintains this force without any perceptible permanent change.

"We cannot but assume it (the maintenance of this force,) depends solely on the mechanical laws of nature; and in this view, we are led, irresistibly, to the conclusion that there exists in nature, a principle of absolute reproduction of mechanical force. * * * However imperfect may be the principle of Ericsson's caloric engine, yet it resembles the sublime reproducing principle of nature." pp. 59-64.

He who, aspiring beyond the present, boldly ventures into new regions in search of, and succeeds in bringing in, a new force, who tames and trains it into the habits of a popular laborer, will ever be deemed a genius and a patriot of the first order. A greater glory is not reserved for man than would be his, because a more beneficent gift could not be conferred on his species. Like other prime desiderata, this is not to be

had cheaply. Difficulties of no common kind are to be overcome ere it be reached.

Shy and recluse, it will be hard to find, and harder still to capture and subdue. Unlike the high imaginings of those whose labors are confined to marble and canvas, the engineer cannot move a step beyond nature; the principles he has to do with are inflexible as adamant. Poets and painters can throw to the winds the law of equality of cause and effect, while he breaks down the moment he attempts to stretch or ignore it. Not even preternatural efforts, perseverance, and inventive resource, can then avail him. The pleasing dream of success may be prolonged, it *cannot* be fulfilled.

Note.—The caloric engine, it is said, is now about to appear in a new form. Condensed air is to be used: the results must, of course, be the same. No preliminary treatment of air, and no amount of mechanical ingenuity expended on it, can draw from it a virtue it does not possess.

Washington, April 8, 1854.

For the Journal of the Franklin Institute.

Memorandum of Experiments made on the 14th, 15th and 16th April, 1854, with two Jonval Turbines, built by Emile Geyelin, Philadelphia, and erected in the Social Cotton Mill belonging to Messrs. Dexter, Ballou & Co., Woonsocket, Rhode Island.

The experiments were made in presence of Messrs. Oren A. Ballou, S. L. Wild, Superintendent of the Mill, Arnold Jillson, Head Machinist, Emile Geyelin, and several Manufacturers, and other gentlemen interested in the result.

The experiments were begun on the 14th of April, with the test of the amount of machinery the largest of the two Jonval Turbines would drive with full gate open, or all the water on, which it could use.

On the next days, April 15th and 16th, both Turbines were experimented upon for the purpose of ascertaining the per centage of power produced by each Turbine separately. The mode adopted to obtain said per centage, was,

1st. To determine the correct amount of cubic feet of water each Turbine would use per minute, with full gate open, when the other was entirely closed. Then, by multiplying the number of cubic feet obtained by the specific gravity of a cubic foot of water; and, further, by multiplying said result by the amount of fall of water in feet, we obtained the theoretical power of the water. The peculiar formation of the race-way leading the water to the Turbines of the mill, (being a regular trench of equal breadth and depth, between well made cemented walls, and cemented bottom, and of some 300 feet in length,) was well adapted to obtain the accurate amount of cubic feet of water each Turbine used during the respective experiments. A float, made of boards the size of a section of the race-way, balanced so as to float in a vertical position and transversal to the length of race-way, afforded a rare opportunity to obtain said data with entire accuracy. The general mode being by means of waste-boards or orifices under a certain pressure, and thus being

obliged to refer to tables containing coefficients, which are always more or less subject to errors in their application, owing to slight variations in the shape of orifices or waste-boards.

2d. Having thus obtained (by means of the float) a correct result of the number of cubic feet used, we obtain the effective power produced by the hydraulic motor, by means of a dynamometer of Prony applied to the main horizontal line shaft of the mill. The mode of trial and accuracy of this apparatus are too well known to require further notice. It is, however, to be remarked that, owing to the peculiar locality of the apparatus on said line shaft, we were obliged to bring the weight suspended at the extremity of the lever over a pulley, thus creating a friction, which we ascertained by a counter-balance.

It is further to be remarked that the actual per centages produced by each Turbine, are somewhat greater than the following calculations will show, owing to the fact that the actual motion and power of the Turbines had to be transmitted from the Turbine shaft to the line shaft by means of a pair of mortised bevel wheels, which, in addition to the four bearings of said line shaft, absorbed some power, which the dynamometer could not, of course, indicate. The amount of power necessary for the transmission of 100 horse power at a velocity of 135 revolutions per minute through said gearing, we had no means of ascertaining; but it would be safe to say that the actual per centage of the Turbine must have been from 1 to $1\frac{1}{2}$ per cent. greater than what was obtained by the dynamometer itself.

On April 14th, 1854, the large Turbine was started, separately, and the small one closed and detached from the line shaft. This was done for the purpose of showing the amount of machinery it would drive with the right speed, when fully loaded and the gate wide open.

The machinery was counted by Mr. Seth L. Wild, Mr. Arnold Jillson, and Emile Geyelin, and was as follows:—

72	Cards, 36 inches each; 2 lappers, 36 inches; 1 willow or whipper, 3 beaters each; 4 railway heads; 8 speeders, or English fly frames, 5 fine, of 160 spindles each, and 3 coarse, of 80 spindles; making in all, ...	1,040
2	Drawing frames of 4 heads each; 8 boss rollers.	——
4	Spoolers; in all 320 spindles.	
4	Dressers.	
4	Warpers.	
4	Pair of self-acting mules of 1728 spindles each, }	
1	" " " 1200 " " } . .	8,112
33	Throstle spinning frames, spindles in warps, making in all, .	2,448
	Total Spindles, .	10,560
138	Looms at 116 picks.	
	All the shafting for 15,000 spindles and 300 looms.	

Data obtained from the measurement of amount of water when the large Turbine alone was in operation, with full gate open, and at the time when the dynamometer was applied at the line shaft:

As stated above, the mode adopted for the measurement of the quantity of water was, by means of a float, which was put transversely in the race-way, and left to float in a vertical position towards the Turbine. At each side we had a man to prevent any tendency of deviating from

the position in which it was intended to float. After being fairly started in its course towards the Turbine, it was repeatedly tried, and found that it traveled 135 feet in four minutes.

Velocity of water, .	135 feet in 4 minutes	=	33·75 feet per minute.
Width of raceway, .	19 feet 11 inches	=	19·91 feet.
Depth of raceway, .	5 " 5 "	=	5·415 "
Section of raceway, . . .	$19·91 \times 5·415$	=	107·81 square feet.

Quantity water used per min. = $(107·81 \times 33·75)$, or 3638·58 cub. ft. per min.
Fall of water during the experiment, 20 feet 3 inches = 20·25.

Data obtained by the dynamometer being applied to the line shaft instead of the Turbine shaft itself:

The proportions of the bevel wheels are—

Mortise wheel on Turbine shaft, . . .	75 teeth.
Pinions on line shaft, ...	51 "

Owing to the greater facility of counting, the speed was taken on the Turbine shaft itself, and requiring, therefore, in the following calculations, to be augmented in the ratio of the above-named mortise bevel wheels. Radius of lever of dynamometer, or length of arm of brake, 11 feet 10 inches; number of revolutions of Turbine shaft, 122 per minute, giving $\frac{122 \times 75}{51} = 179·40$ speed of the line shaft. Net weight attached to the end of the lever, 310 pounds.

Experiments made on the Small Jonval Turbine, on the afternoon of the 15th of April.

The amount of water was measured with the same float and exactly in the same manner as at the experiment of the large Jonval Turbine; further, the dynamometer was left in the same position on the line shaft, and at noon the large Turbine was detached, and the small one brought in connexion with the said line shaft.

Data of measurement of water at the trial of the small Turbine:

Velocity of water, or speed at which the float traveled in raceway,	18·70 ft per min.
Width of raceway, . . .	19 feet 11 inches = 19·91
Depth " during the time of the experiments, . .	6 feet.
Section "	$19·91 \times 6 = 119·46$ square feet.
Quantity of water absorbed, .	$= 119·46 \times 18·70 = 2233·90$ cb. ft pr mn.
Fall of water during the experiments,	20 feet 7 inches = 20·58.

Data obtained in experiment No. 1, when the dynamometer was applied to the line shaft in connexion with the small Turbine:

The speed was again counted on the Turbine shaft itself, and was found to be from 139 to 140 revolutions per minute.

Mortise bevel wheel on Turbine shaft, . .	64 teeth.
Pinion on line shaft, ...	51 "
Number of revolutions on Turbine shaft, . .	139·50

$\frac{139·50 \times 64}{51} = 175$ R. as speed of line shaft.

The radius of lever of dynamometer remained the same as in the experiment of the large Turbine, or .	11 feet 10 inches.
Net weight attached to the end of the lever, .	179½ lbs.

Data obtained in experiment No. 2, when the dynamometer was applied to the line shaft, in connexion with the small Turbine:

The speed was again counted on the Turbine shaft, and was found to be 133 revolutions per minute.

$$\frac{133 \times 64}{51} = 166{\cdot}90 \text{ R. as speed of line shaft.}$$

The radius of lever remained the same, 11 feet 10 inches; net weight attached at the end of lever, $192\frac{1}{2}$ lbs.

During experiment No. 2, small Turbine, the amount of water used, and fall, was supposed to be the same as during experiment No. 1.

$19{\cdot}91 \times 6 \times 18{\cdot}70 = 2230{\cdot}90$ cubic feet per minute; fall, 20 feet 7 inches $= 20{\cdot}58$.

Experiment on Large Turbine.

Calculation of water power, (theoretically,) $\dfrac{3638{\cdot}53 \times 62{\cdot}5 \text{ lbs. pr. cu. ft.} \times 20{\cdot}25 \text{ ft. fall,}}{33000}$

$= 139{\cdot}55$ horse power.

Calculations of Power obtained by Dynamometer from the Large Turbine.

Radius of lever, . . . 11 feet 10 inches, or 11·833

Circumference, $= 2\pi R = 23{\cdot}666 \times 3{\cdot}1416 = 74{\cdot}349$ feet, or 74·35 feet.

Number of revolutions per minute . . . $= 179{\cdot}40$

$$\text{Power} = \frac{C \times \text{N. of Rev.} \times w}{33000} = \frac{74{\cdot}35 \times 179{\cdot}40 \times 310{\cdot}00}{33000} = 125{\cdot}30 \text{ horse power.}$$

Theoretical horse power of the water, 139·50 horse power.

Actual horse power as obtained by dynamometer, 125·30 " "

——— 0·8098 or 0·81 per cent.

Experiment on Small Turbine, No. 1.

Calculation of water power $= \dfrac{2230{\cdot}90 \times 62\ 5 \times 20{\cdot}58}{33000}$. Fall in feet $= 87{\cdot}07$ h. power.

Calculation of Power obtained by Dynamometer.

Radius of lever, . . . 11 feet 10 inches $= 11{\cdot}833$

Circumference, . . $20\ R = 23{\cdot}666 \times 3{\cdot}1416 = 74{\cdot}35$ feet.

Number of revolutions of line shaft during the experiment, $= 1{\cdot}75$

$$\text{Power} = \frac{C \times \text{N. or R.} \times w}{33000} = \frac{74{\cdot}35 \times 175{\cdot}00 \times 179\frac{1}{2}}{33000} = 70{\cdot}86 \text{ horse power.}$$

Theoretic Horse power of the water, . 87·07

Actual horse power as shown by dynamometer, 70·86

——— per centage = 0·813.

Experiment on Small Turbine, No. 2.

Calculation of water power $= \dfrac{2230{\cdot}90 \times 62{\cdot}5 \times 20{\cdot}58}{33000} = 87{\cdot}07$ per centage horse power.

Calculation of Power obtained by Dynamometer.

Radius of lever, . . . 11 feet 10 inches = 11·833

Circumference, . . $2\pi R = 23{\cdot}666 \times 3{\cdot}1416 =$ 74·35 feet.

Number of revolutions per minute, . . $= 166{\cdot}90$

Weight suspended at the extremity of the lever, . $192\frac{1}{2}$ lbs.

$$\text{Power} = \frac{C \times \text{N. of R.} \times w}{33000} = \frac{74{\cdot}35 \times 166{\cdot}90 \times 192{\cdot}50}{33000} = 72{\cdot}38 \text{ horse power.}$$

Horse power by water, . . . 87·07

Horse power by dynamometer, . . . 72·38

——— 0·83 per centage.

Average per centage of both Turbines at all the Experiments.

0·0998
8·813
0·83

———

2·4528 = 0·8176 per cent.

On the Results of a series of Experiments on the Decomposition of Water by the Galvanic Battery, with a view to obtain a constant and brilliant Lime Light. By the Rev. N. J. Callan, Prof. of Nat. Philos. in the Rom. Cath. Coll. Maynooth.*

(Continued from p. 257.)

To estimate the comparative expense of the coke light and the lime light, it is necessary, first, to determine the size of the battery which will produce a brilliant coke light, with that of one, which, by decomposing water, will produce a lime light of equal illuminating power; and secondly, to determine the time each battery will work with a given charge. Although I made a battery of a size which I thought would be most advantageous for producing the coke light, I have not as yet succeeded in determining satisfactorily either of these two points. The battery which I prepared consisted of 60 cast iron cells in which each zinc plate was 4 inches by 2. In the battery which I commonly used, the zinc plates were 4 inches square. I always found that this battery soon destroyed the coke points. On one occasion, about five years ago, I got a coke light sufficient for the gas microscope from a battery of 24 cells, which were only half-filled with acid. Hence I inferred that zinc plates, 2 inches by 4, would be large enough for a brilliant coke light. When the battery of 60 cells, in which the zinc plates were 2 inches by 4, was prepared, I sent the current, first, from thirty of them through a pair of coke points. The light was sufficiently brilliant for all illuminating purposes, but did not last very long. I then changed the connexion that I might try the effect of 40 cells. The light was then both steady and brilliant. I think that this is the smallest, and therefore the least expensive battery, by which, with the aid of a good apparatus for adjusting the coke points, a continuous light of great illuminating power can be obtained. If the plates be smaller, the illuminating power of the coke points will not be sufficient; and if the number of cells be less than 40, the electric current will not have sufficient intensity to pass through the flame between the coke points. With this battery a pair of coke points lasts a long time. I have found that when the battery is not very powerful, the brilliant light comes only from the positive coke point. For, if a coke point and a copper point be used instead of two coke points, and if the coke point be connected with the positive end of the battery, the light is as brilliant as if two coke points were employed. But if the coke point be connected with the negative, and the copper point with the positive end, the light will be worthless. I forgot to make this experiment when I had occasion to use a very powerful battery. I may mention here that with 60 cast iron cells in which the zinc plates were 2 inches by 4, I was able to fuse and deflagrate a round piece of steel $\frac{1}{4}$ inch diameter. Although I made a far greater number of experiments on the lime light than on the coke light, I am not able to state positively the size of the battery, which, by decomposing water, would produce a lime light equal in illuminating power to that of a pair of coke points

* From the Lond., Edin., and Dub. Philos. Mag., Feb., 1854.

ignited by a battery of 40 cast iron cells in which the zinc plates are 2 inches by 4. I can only say that I think it probable that a battery twice, or very nearly twice the size, would be required. With regard to the length of time the two batteries would work with a given charge, I am equally uncertain. In decomposing water, all the cells must be arranged in rows of four each, so that the intensity of the current may not exceed that of 4 cells. Now, when a current is sent from 4 cells through a good conducting fluid, the quantity of electricity which passes through the fluid and through each cell of the battery is only about one-half of the quantity which would pass if the ends of the battery were connected by a short, thick wire. This I have found by the galvanometer. Hence the battery would work about twice as long in the former as in the latter case. When the coke points were ignited by 40 cells, I measured the angle of deviation of the sine galvanometer, and found it to be 31° when the needle was in the axis of the coil, and nearly 10 inches from its centre. When they were ignited by 60 cells, the deviation was 40°. Unfortunately, I did not measure the angle of deviation which would be produced by the current passing directly through the coil of the galvanometer. The experiments were made before my class, and I intended to measure on the next day the angle of deviation which would be produced by the current from 4 cells of the same size, sent through a fluid. I was prevented from making the experiment until I had occasion to remagnetize the needle, and consequently I cannot now depend on its indications being the same they would have been on the day the battery of 40 and 60 cells was used. I have since tried the effect of a current from four of the cells on the sine galvanometer after passing it through a solution of carbonate of soda, and found that a deflexion of $21\frac{1}{2}$° was produced in the needle of the sine galvanometer. But I am inclined to think that had I made the experiment the day I used the 40 cells, the deflexion would have been considerably less, because the needle was not then so highly magnetized. The impression made by all my experiments inclines me to believe that a battery would work nearly twice as long in decomposing water as in igniting coke points; that, therefore, the coke light and the lime light are nearly equally expensive, but that the former is somewhat more economical. I shall soon have occasion to exhibit a battery of about 250 cast iron cells, and intend then to compare the quantity of electricity which will pass between a pair of coke points ignited by 40 cells, with that which will pass through a thick wire connected with the opposite ends of the same 40 cells. I intended to investigate the decomposing power of the coil, but I must defer the investigation till health and leisure permit me to resume my experiments.

Maynooth College, January 2, 1854.

P. S. I have got a new iron vessel made of a rectangular form, for which I am preparing two sets of electrodes; one for a battery of low intensity, the other for a battery of high intensity. The former will consist of 100 iron plates coated with an alloy of lead and tin; 50 of them (the alternate plates) will be connected with one end of the battery, and the other 50 with the opposite end. The 100 plates will be divided into twenty

groups, each containing 5 plates. Each group will be covered all round with linen, so that the foam produced by the ascent of the gases in the solution of soda may be made to pass through the linen, and that thus the bubbles may be broken. This arrangement of the electrodes will answer for a battery of 60 cast iron cells arranged in fifteen rows of four each, and in which each zinc plate is 6 inches by 4. The quantity of the gases produced by each group of 5 plates will be equal to that which would be produced by 3 cast iron cells, or the $\frac{1}{20}$th of 60. Now I have found that a linen cover on the electrodes prevents all foam when the battery does not contain more than 5 or 6 cells, in which each zinc plate is 6 inches by 4. Therefore, in the arrangement just described there can be no foam. The electrodes for a battery of high intensity will consist of 156 coated iron plates, divided into twelve groups, each containing 13 plates. The 13 plates of each group will form 12 decomposing cells nearly water-tight, and open only at top. The first plate of each group will be connected with one end of the battery, and the last with the opposite end. Hence when the cells are nearly filled with a solution of soda, the voltaic current will pass simultaneously from the first to the last plate of each group, through the intermediate plates and fluid, and produce decomposition in each cell. This arrangement is intended for a battery of 60 cells, in which each zinc plate is 6 inches by 4, all acting in one series. The intensity of the current from this battery will be reduced to that of 5 cells by passing through the 12 decomposing cells. Each group of 13 plates will be covered with linen, which will prevent all foam, because in each group the quantity of the gases will be only equal to that which would be produced by 5 cells or by $\frac{1}{12}$th of 60.

January 25, 1854.

For the Journal of the Franklin Institute.

Notes on Blanchard's Patent Timber Bending Machine. By Wm. H. Shock, Chf. Eng., U. S. Navy.

The Timber Bending Association of New York, having purchased a lot of ground on Green Point, have erected thereon a spacious building with the necessary machinery for bending timber, and may be considered as having commenced operations, in this new and important undertaking, and with the most gratifying prospects of success.

During a recent visit to the establishment, I was gratified as well as pleased in witnessing the working of the machinery. It was truly wonderful to observe with what despatch, and apparent ease, the various pieces of wood were moulded to the desired shape. One of the most important features in the machinery, is its simplicity and cheapness.

In addition to the larger machines, for bending ship-timber, they have several smaller ones for shaping material for furniture, such as table frames, chair bottoms, backs, &c., &c., a specimen of which, I have caused to be forwarded to the Institute for its inspection. They propose, however, to devote their time exclusively to the bending of ship-timber, and some idea may be formed of their operations from the following:—A piece of white oak, 15 feet, 8 inches long, and $10 \times 9\frac{3}{4}$ inches in

section, was bent complete for a ship's futtock, in seven minutes from the time it was taken from the steam bath. Four knee pieces, 7 feet long, $6\frac{1}{2} \times 5\frac{1}{4}$, were taken from the bath, and a right angled knee formed from each piece, requiring three minutes for each. One piece of black walnut, 6 inches wide, one inch thick, and 6 feet long, intended for chair bottom frames, was formed in one minute from the time it was taken from the steam bath.

Experience will no doubt suggest many improvements in the machinery, notwithstanding they seem to think it is just what they require.

They claim for the bent knees, *greater strength* than those of *natural growth*; this is a point, however, which must be decided by experiment, as well as experience. It certainly is an important invention, well suited to the present times, when angular-shaped timber of natural growth for ship-building is becoming so scarce and expensive. It is proper to remark that in bending the futtock-piece and four knees as above stated, not the slightest evidence of fracture or straining of the fibre of the wood was apparent.

It is necessary to retain the pieces bent in braces, until it is cool, at which time it has its permanent set, and I am informed that no exposure to sun or rain affects it, which has been proved by experiment.

I am informed that a series of experiments, by order of the Government, will shortly be made to test the strength of the wood formed by this process.

For the Journal of the Franklin Institute.

Notes, with abstracts from the Steam Log of the Steamer St. Louis, during her late voyage to Havre and back. By Wm. H. Shock, Chf. Eng. U. S. Navy.

The Steamer *St. Louis* was originally built and fitted for the California trade in the Pacific Ocean, but in consequence of the loss of the *Franklin*, upon the coast of Long Island, she was temporarily transferred to the New York and Havre line, to supply the *Franklin's* place, and left New York for Havre, August 1, 1854, with passengers and mails.

The *St. Louis* is a fine working vessel of 1653 tons measurement, rigged as a fore-top-sail schooner, and supplied with two top-beam engines of the following dimensions:

Diameter of cylinder,		50 inches.
Length of stroke,	10 feet.	
Diameter of air pump,		30 inches.
Stroke " "		57 "
Water wheel (ordinary radial)—Diameter,	30 feet.	
Face of water wheel,	9 "	
Width of bucket,		16 inches.
Number of buckets in each wheel,	28.	

She has *Pirssons's Surface Condenser* attached to the *port* engine, and the ordinary jet conductor to the *starboard* engine, and so connected with each other, as to admit of one air-pump discharging both condensers, in the event of accident to one of the pumps, the same in all respects as the Steamer *Sonora*, a sister ship, and described by me in a late paper upon the performance of that vessel during her late cruise to the Pacific.

The performance of the *St. Louis* was highly satisfactory to her officers,

to one of whom, (her Chief Engineer, J. W. Marshall,) I am indebted for the following extracts and notes, taken from her steam log during her late cruise from New York to Havre and back.

Left New York, August 1st, at 9, A. M. Arrived at Cowes, August 13, at 7, A. M., landed mails and passengers, and got under way for Havre. Arrived at Havre at 4·30 on the same afternoon.

From Cowes to Havre, they sustained a loss of 40 minutes, blowing engines, &c., which is included in the above time, making the run to Cowes in 11 days, 22 hours, and to Havre 12 days, 9 hours, 30 minutes, including all detentions. The numbers which here follow are *averages* for each day :

Abstract of Steam Log on Outward Passage.

Date.	Steam.	Revo's.	Distance. Miles.	Coal. Tons.	Saturation. Star'd. Boiler.	Throttle	Vacuum. S.	P.	Cut off. Inches.
Aug. 2,	22	20087	295	26	$1\frac{3}{4}$	Full.	25	25	64
" 3,	18	18874	225	29	$1\frac{3}{4}$	"	25	25	64
" 4,	17	19360	255	28	$1\frac{3}{4}$	"	25	25	64
" 5,	20	20349	255	30	$1\frac{3}{4}$	"	25	25	64
" 6.	21	21215	255	31	$1\frac{3}{4}$	"	25	25	64
" 7,	20	21368	270	32	$1\frac{3}{4}$	"	25	25	64
" 8,	18	21128	255	30	$1\frac{3}{4}$	"	25	25	64
" 9.	18	21218	265	29	$1\frac{3}{4}$	"	25	25	64
" 10,	19	22355	288	30	$1\frac{3}{4}$	"	25	25	64
" 11,	17	21523	260	25	$1\frac{3}{4}$	"	25	25	64
" 12,	17	23428	280	30	$1\frac{3}{4}$	"	25	25	64
" 13,	17	21957	To dock	29	$1\frac{3}{4}$	"	25	25	64

Remarks.—The fresh water from patent condenser was used entirely in port boiler. Coal, Bituminous.

On her return trip to New York, she left Havre for Cowes, at 1·20 P. M., August 30. At 12·20 A. M., August 31, stopped at Cowes for mails and passengers, and at 2·45 A. M., September 1, left Cowes for New York; and arrived at her dock at 1, P. M., September 12, 1854, running the distance in 11 days $10\frac{1}{2}$ hours from Cowes to New York. Whole time from Havre to New York, including stoppages, &c., 13 days, 11 hours, 40 minutes.

Abstract from Return Trip.

Date.	Steam.	Revo's.	Distance. Miles.	Coal. Tons.	Saturation.	Throttle	Vacuum S.	P.	Cut off. Inches.
Aug. 31,	20	15777	100	20	$1\frac{3}{4}$	Full.	$25\frac{1}{4}$	$25\frac{1}{4}$	64
Sept. 1.	23	18668	240	23	$1\frac{3}{4}$	Open.	$25\frac{1}{4}$	$25\frac{1}{4}$	64
" 2,	22	19056	260	21	$1\frac{3}{4}$	"	$25\frac{1}{4}$	$25\frac{1}{4}$	64
" 3,	$23\frac{1}{2}$	20059	265	28	$1\frac{3}{4}$	"	$25\frac{1}{4}$	$25\frac{1}{4}$	64
" 4,	23	20083	260	33	$1\frac{3}{4}$	"	$25\frac{1}{4}$	$25\frac{1}{4}$	64
" 5,	22	19881	250	28	$1\frac{3}{4}$	"	$25\frac{1}{4}$	$25\frac{1}{4}$	64
" 6,	$20\frac{1}{2}$	19807	280	30	$1\frac{3}{4}$	"	$25\frac{1}{4}$	$25\frac{1}{4}$	64
" 7,	$23\frac{1}{2}$	21339	260	32	$1\frac{3}{4}$	"	$25\frac{1}{4}$	$25\frac{1}{4}$	64
" 8,	23	21304	240	33	$1\frac{3}{4}$	"	$22\frac{1}{4}$	$25\frac{1}{4}$	64
" 9,	$23\frac{3}{4}$	20708	230	38	$1\frac{3}{4}$	"	$25\frac{1}{4}$	$25\frac{1}{4}$	64
" 10,	22	20460	220	30	$1\frac{3}{4}$	"	$25\frac{1}{4}$	$25\frac{1}{4}$	64
" 11,	$19\frac{1}{2}$	21764	297	29	$1\frac{3}{4}$	"	$25\frac{1}{4}$	$25\frac{1}{4}$	64
" 12,	21	21867		29	$1\frac{3}{4}$	"	$25\frac{1}{4}$	$25\frac{1}{4}$	64

Remarks.—Boilers managed same as before. Coal, Welsh.

We have to regret in this case, as with most of our sea steamers, the absence of indicator diagrams, by which only, can we arrive at correct conclusions as to the efficiency of the engines, boilers, &c.

For a full detail of all the dimensions of the *St. Louis*, see *Franklin Institute Journal*, page 353, vol. xxvii.

For the Journal of the Franklin Institute.

Trial Trip of the Steamer John K. Hammit. By Washington Jones.

This steamer, built for the Laguayra and Porto Cabello Steam Packet Company, (the particulars of engine and hull will be found in the *Journal of the Franklin Institute*, Vol. xxvii, page 282. The estimated number of turns is there stated to be 26. It should have been 36,) went on the engineer's trial trip, October 21st. The following is an account of her performance and condition at the time:

Ketch Rigged.—

Draft forward,	7 feet.
" aft,	8 " 6 in.
" mean,	7 " 9 "
Amidship section immersed,	140 sq. ft.

The time of passing the measured distances, pressure of steam, vacuum, and number of revolutions, was carefully noted, and will be found in the subjoined table. The boiler furnishes an ample supply of steam with natural draft, burning bituminous coal.

Time down.	Place.	Pressure of Steam in pounds per gauge.	Vacuum in inches per gauge.	Revolutions of engine.
A. M. 10·31	Navy Yard Shears,	30	26	40½
" 10·46	Powder Piers,	30	26	41½
" 11·22½	Fort,	28	26	41
P. M. 12·21	Chester,	21	26	38

The vessel was rounded to, passing below the bar of Chester island, and headed for the return to the City through the west channel.

Time up.	Place.	Pressure of Steam.	Vacuum.	Revolutions.
P. M. 12·41	Chester,	30	26	42
" 1·24	Fort,	26	26	40½
" 1·42	Powder Pier,	29	26	41
" 2·2	Navy Yard Shears,	30	26	43

The measured distance run to Chester from Navy Yard Shears and back, is thirty miles, to which must be added the opposing current of a strong flood tide, during the run down, and a reduction made for its assistance in returning from Chester to the Fort; the remaining distance was run in nearly slack water. No change was observed in the wind, which blew tolerably strong, and was in favor down, but in opposition

up; the two effects may be considered as neutralizing each other, and be disregarded.

Distance from Navy Yard Shears to Chester, .		15 miles.
Add for current of $2\frac{1}{4}$ miles per hour, acting for one hour and fifty minutes, ...		4.6 "
Distance back to Navy Yard Shears, .	15 miles.	
Deduct for current of latter part of flood tide, ·75 mile per hour during 43 minutes time, .	·54 "	
		14·46 "
Actual distance through the water, . .		= 34·06 "

Time occupied in running to Chester from Navy Yard Shears,	1 hour 50 min.
" " from " to " " "	1 " 21 "
	3 " 11 "

By dividing is found the average speed of the vessel through the water $= 10·7$ miles per hour, or 941·6 feet per minute.

The pitch of the propeller at centre of pressure is, 14·71 feet, and it completes two revolutions for one of the engine. By averaging the turns made by the engine, we get for the theoretical progression of the propeller per minute,

	$41\frac{1}{8} \times 2 \times 14·71 =$	1209·9 feet.
Progression of vessel,	.	941·6 "
Slip,	.	268·3 "

or over 22 per cent.

It is expected, that the per centage of slip will be reduced when the vessel is brought to trim more by the head, which will make the angle of the entrance finer. The model of the hull is good; and from the known reputation of the builders, Messrs. J. K. Hammit & Son, has had justice done it in the construction. Not being designed for great speed, the route being short, but a comparatively small amount of engine power was placed in her; so the result of the trial was very satisfactory to contractor as well as builders. She will sail for her destination, to be placed upon her intended route, about the last of October.

For the Journal of the Franklin Institute.

Notes on the Cloud Combination of Steam and Air. By Wm. H. Shock, Chf. Eng., U. S. Navy.

By invitation, I lately visited an establishment in New York, where they have a small engine for driving three of "Hoe's Patent Printing Presses," and in which they use the *Cloud Combination* of *Steam and Air*.

I here submit the facts, collected during my visit, (with two reports made by Horatio Allen, Esq., of New York, annexed,) hoping they will prove an incentive to a further examination of the principles of this phenomena in steam engineering.

The engine used for driving the above presses, is of that class known

as the square engine, 10 inches stroke and about 5 inches diameter. (I had no correct method of arriving at the exact diameter.)

The piston rod is continued above the cross head with reduced diameter, and up through the engine frame, upon which sets the air pump, 10 inch stroke and 2 inches in diameter, forming an arrangement of piston not unlike that of the Worthington pump.

A separate eccentric is used for working the *steam* expansion valve, also, one for working the *air* valve.

The steam chest is the same in all respects, as those usually found on engines with the short slide valve, with the addition, however, of a face on one side of the chest, to admit the air, or, in other words, an air chest on the side, and opening into the steam chest.

The air is compressed, (as shown by gauge,) to exert a pressure, varying from 15 to 20 lbs. per square inch, and is admitted into the cylinder for $1\frac{1}{2}$ inch of the stroke of the piston, and then steam of a pressure of 80 lbs. per square inch for the following two inches, when all communication to the cylinder is closed, the engine making from 65 to 70 revolutions per minute, driving all the *presses*, *but as soon as the air communication to* the cylinder was closed and the operation of the engine depended upon *steam alone*, its speed was immediately reduced, and finally stopped, and it was found that with all the *steam* they could get, it was impossible to drive *one press.*

I am further informed, that the cooler the compressed air enters the chest, the more satisfactory are the results to be obtained, and to that end, it is proposed to immerse the air pump and pipes as far as practicable in a cold bath.

The coal consumed during the working hours (10,) varies from 170 to 200 pounds (anthracite.)

As before stated, Mr. H. Allen conducted a series of experiments, and made reports, of which I have been kindly supplied with copies.

The following appears in the report, dated July, 1854.

"A steam engine, 8-inch diameter of cylinder, and 12-inch stroke, with suitable boiler, was fitted up, and also provided with the means of working an air-pump, and the valves required for introducing air into the cylinder. The revolutions of the engine were controlled by the friction of a pulley. As the same pulley, weight, and appurtenances were used in all cases, and great care was taken to keep a full and uniform supply of water to the surface of the pulley, a great uniformity of resistance was obtained.

"After working the engine as a steam engine at various degrees of expansion, it has been found that, with a pressure of 70 pounds in the boiler, the best results have been obtained by letting on the steam for 2 inches of the stroke.

"With the valves so adjusted, the result of the trials with steam alone, gave 170 revolutions for one pound of coal.

"Having made the trials with steam alone, the same engine was prepared for cloud combination by adding the air-pump and valves.

"In this arrangement, the air was let on for $1\frac{1}{2}$-inch stroke at its commencement, and then steam (boiler pressure 70 pounds,) for the following 2 inches. The performance of the cloud combination, as shown by several trials, exceeded 250 revolutions for one pound of coal.

"In making these trials of the cloud combination, it has been found that when steam of about 60 pounds pressure is combined with air of from 15 to 20 pounds pressure only, there results a pressure from the combination exceeding that of the steam, at least 10 to 15 pounds.

"This important fact was clearly brought out by the pressure gauges attached to the

steam chest, which indicate the pressure of steam, both before the combination and after the combination. An increase of pressure of 15 to 16 pounds is invariably indicated.

"Another manifestation of this increase of pressure, is found in the operation of the check-valve in the steam pipe, through which the steam is introduced. This valve opens with the current of steam. When the engine is used as a steam engine, this valve closes gently by its own weight as soon as the cut-off stops the current of steam, but when the *cloud combination* is being used, this valve closes very soon after the steam is let on, and before the cut-off closes, with a degree of violence that shows there has resulted from the combination of steam and air, an expansive effect much exceeding that of the steam used.

"As the result of the trials referred to, I have to state that the increase of pressure arising from combination of steam and air, is proved beyond a doubt, and that the increased useful effect resulting from this increased pressure, as shown by these trials, is over 50 per cent."

In August, 1854, a larger boiler was substituted for the one used in the above experiments, and the following tabulated report made :—

"I have repeated the trials of cloud combination with same engine, but a larger boiler. The following is a statement of results:

First.—Steam alone.

Steam in boiler.	Steam in chest.	Coal to raise steam.	Coal while running.	Revolutions.
110 lbs.	100 lbs.	156 lbs.	156 lbs.	16,759

"Stopped three times for ten minutes. Time of trial, four and a half hours. Running time, four hours.

"16,759÷156=107 revolutions for 1 lb. coal.

Second.—Cloud.

Boiler.	Chest.	Air.	Coal to raise steam.	Coal while running.	Revolutions.
110 lbs.	100 to 110	18 lbs.	156 lbs.	104 lbs.	19,749

"Running time, four hours.

"19,749÷104=190 revolutions for 1 lb. coal.

"Cut off for steam, at 1½ inch of stroke, expanding 7½ times.

"Cut off for air 1½ inch, and for steam 1½ inch, expanding 4 to 6 times.

"It will be seen, that the performance with steam alone is under as favorable circumstances as can be provided in a high pressure engine. The expansive principle is fully carried out, and nothing is wanting to make the performance by steam alone, a fair standard with which to compare the cloud engine; and this performance has been largely exceeded by the—

"*Cloud Engine.*—I have previously reported the result of former trials, in all which the performance of the cloud engine has much surpassed that of steam alone.

"It therefore appears to me, that but one conclusion can be drawn from these trials, and that is, that by the cloud combination, a very large saving will be effected.

"The means to be used are simple, and involve no difficult mechanical combination.

"What the proportion of saving is to be, remains to be determined by more extensive use, but I am constrained by the facts which have been developed by these trials, to state my belief that the cloud combination will take the place of the high pressure engine, and prove itself one of the most extraordinary and valuable inventions of the age."

That the results observed by Mr. Allen in his experiments with the cloud combination, are most extraordinary, is beyond a doubt, and deserving of further experiments upon a larger scale.

Translated for the Journal of the Franklin Institute.

A Pocket Barometer. By M. C. Brunner, Poggendorff, Annalen, 1854.

This instrument is composed of two parts, which are carried separately, and fitted to each other when the instrument is to be used. One of these pieces, similar to the Forten barometer cistern, is a hollow iron cylinder containing mercury, the level of which can be raised or lowered by the movement of a screw. This reservoir may be closed by a cover when it is to be carried about, and to prevent the mercury from being heated when held in the hand, the cistern is wrapped in woolen stuffs.

The second part is composed of two concentric glass tubes. The external tube, of pretty large diameter, is open below, but hermetically closed at its upper end by a plate of copper traversed by the inner tube, which is open at both ends.

To make an observation, the two pieces are put together by screwing. The level of the mercury is raised by turning the screw of the cistern, and it is evident that at the moment the lower end of the inner tube dips into the mercury, there is, in the annular space inclosed between the two tubes, a certain volume of air, which will be the same in all observations. The level of the mercury in the cistern is raised until it touches an iron point placed at a suitable height. The mass of air is thus reduced to a smaller volume, and in every experiment the diminution of volume is the same. At the same time, by the increase of the elastic force of the interior air, the mercury rises in the central tube, which is open at its upper end, by a quantity which depends on the initial pressure of the atmosphere. To determine exactly the height of the column raised, a rod terminating in a point at its lower end, may be raised or lowered in the inner tube by means of a rack, and a scale fitted to this rod shows the distance of this point, which is made to touch the surface of the mercury in the inner tube, from the point in the cistern, which corresponds to the lower level of the mercury.

If h be the height thus indicated, H the unknown barometric pressure, v and v' the initial and final volumes of the included air, then, if we admit Mariotte's law to be true for air at ordinary pressure,

$$v : v' :: \mathrm{H}+h : \mathrm{H}. \quad \text{Whence } \mathrm{H}=h\frac{v'}{v-v'}.$$

This ratio, $\frac{v'}{v-v'}$, by which h is to be multiplied in order to get the true barometric height, will be constant in all the experiments, and it will suffice to determine this coefficient once for all, by making a comparison with the common barometer.

M. Brunner found the value of this coefficient for his apparatus 4·428. To appreciate the value of this instrument, he compared it a number of times with the common barometer; in the ten comparisons which he has cited, the maximum errors are + 2·1 millimetres and — 0·9 millimetres. He attributes these divergences principally to the changes of temperature which the air may undergo during the observation.

On this proposition, the editor of the *Bibliotheque Universalé de Genêve*

remarks, It appears to us that there is a more important cause of error which may lead to much more considerable differences; it is the state of moisture of the air. While we may admit Mariotte's law for dry air, or air far from saturation, we certainly cannot do so when it is saturated with watery vapor; for then the compression will produce condensation of the water. Let us suppose the experiment made under these circumstances; let us designate, by f, the tension of the vapor of water at saturation, at the temperature at which we are operating, and keep the same notation for the other quantities as before; we shall have $H = \frac{v'}{v-v'}\,h + f$.

So that, if we have determined the constant coefficient with air so dry that there was no condensation, and we wished afterwards to make an observation in air saturated at 36° Cent., (86° Fahr.,) (to take an extreme case,) we should make an error of nearly 31 millimetres. Even without supposing the saturation complete, it is known that in vessels of glass, Mariotte's law ceases to be true long before the point of saturation, in consequence of the hygroscopic attraction of the glass determining a condensation of vapor. It is therefore probable that, if the constant coefficient were determined with a certain degree of dampness, whenever the weather was drier, the pocket barometer would indicate too great, and whenever the weather was damper, too small a height.—*Bib. Univ. de Genève: Arch. des Sciences Physiques, tome* xxvi., p. 162.

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Remarks.—While this reasoning is evidently true, we do not regard the objection as fatal in practice to this very ingenious, and probably very useful instrument; for, by the addition of a chloride of calcium tube, it appears to us easy enough to fill it always with dry air. Ed.

Translated for the Journal of the Franklin Institute.

Apparatus for preserving Telegraphic Apparatus from the disturbing influence of Atmospheric Electricity.

"M. Becquerel presented to the Academy, an apparatus invented by M. Barthelemy Bianchi, intended to preserve telegraphic apparatus from the disturbing influence of atmospheric electricity."

This very simple and easily erected apparatus, consists of a metallic sphere, traversed by the circuit wire, and kept in the centre of another glass sphere, formed of two hemispheres united by a broad copper ring, armed at its inside with equi-distant points directed towards the centre of the metallic sphere, and approaching within a short distance of its surface. The two hemispheres end in sockets, into which the connecting wire passes and is cemented. The lower part of the copper ring is provided with a metallic stop-cock, which permits a vacuum to be made in the apparatus, and kept in it, if it be thought necessary. This stop-cock has a screw-thread which is to receive a metallic rod designed to put the metallic armature into direct connexion with the earth, while the circuit wire, and the sphere which forms part of it, are completely insulated.

With this apparatus it is seen, that all the atmospheric electricity which

comes upon the conducting wire of the telegraph, is transmitted to the ground through the points with which the ring is armed.

Such an apparatus is to be erected at each station; experiment has proved to the author, that when the discharge of a battery of eight jars is passed into a telegraphic conductor provided with this apparatus, the dynamic current is not affected, and all the statical electricity passes into the earth, under the influence of the points.

M. Becquerel in presenting the apparatus, expressed the desire that it should be immediately experimented on, on a large scale, on our telegraphic lines.—*Comptes Rendus de l'Academie des Sciences*, (*Paris*,) 15th May, 1854. p. 877.

For the Journal of the Franklin Institute.

Particulars of the Steamer Pelayo.

Hull built by Wm. H. Webb. Machinery by Pease & Murphy. Intended service, Island of Cuba.

Hull.—

Length on deck, from fore part of stem to after part of stern post above the spar deck,	200 feet.	
Breadth of beam at midship section,	31 "	
Depth of hold,	14 "	
Length of engine and boiler space,	58 "	
Draft of water at load line,	10 "	
" " below pressure and revolutions,	9 "	
Tonnage, Custom house, 830.		
Contents of bunkers in tons of coal, 125.		
Masts and rig— Foretopsail Schooner.		

Engine.—Vertical beam.

Diameter of cylinder,		64 inches.
Length of stroke,	8 feet	
Maximum pressure of steam in pounds, 15.		
Maximum revolutions per minute, 18.		

Boilers—Two—single return flues.

Length of boilers,	22 feet.	6 inches.
Breadth "	10 "	3 "
Height " exclusive of steam drum,	9 "	6 "
Number of furnaces, 6.		
Length of grate bars,	5 feet.	6 inches.
Number of flues, 12 in each.		
Internal diameter of flues,		14½ inches.
Heating surface,	2700 sq. feet.	
Diameter of smoke pipe,	5 "	
Height " including steam chimney,	39 "	
Description of coal, Bituminous.		

Water Wheels.—

Diameter,	26 feet.	
Length of blades,	8 "	6 inches.
Depth,		16 "
Number " 24.		

Remarks.—Floor timbers at throats, *molded* 12 in., *sided* 9½ in. Distance of frames apart, *at centres* 30 ins. Floors filled in solid.

C. H. H.

For the Journal of the Franklin Institute.

Particulars of the Steamer Emeu.

Hull built by Robert Napier, Glasgow. Machinery by the same. Owners, Pacific and Australian Steam Navigation Co. Intended service, Panama and Sydney.

Hull.—

Length of keel and fore rake,		257 feet.	
Breadth of beam at midship section,		36 "	6 inches.
Depth of hold,		28 "	6 "
Depth of lower hold,		21 "	
Draft of water at load line,		17 "	
Tonnage, builders' measurement,	1666.		
Area of immersed midship section at this draft,		386 sq. feet.	
Displacement at 15 ft.=1645 tons—at $17\frac{1}{2}$ ft.=2045 tons.			
Contents of bunkers in tons of coal,	900.		
Masts and rig,—	Barque.		

Engines—Overhead Beam—

Diameter of cylinders,			64 inches.
Length of stroke,		4 feet.	
Maximum pressure of steam in pounds,	15		
Maximum revolutions per minute,	$34\frac{1}{4}$=103 of screw.		
" " above pressure and revos., (even keel)		15 "	

Boilers—Four.—

Length of boilers,		14 feet.	6 inches.
Breadth "		11 "	2 "
Height, " inclusive of steam chimney,		11 "	6 "
Number of furnaces,	12.		
Length of grate bars,		6 feet.	4 inches.
Diameter of smoke pipe,		6 "	
Height " " (above grate bars,)		52 "	6 inches.
Description of coal,	Bituminous.		

Propeller.—

Diameter, (Griffith's)		12 feet	4 inches.
Pitch,		15 "	
Number, of blades,	2.		

Remarks.—Frames; *shape and dimensions* ⌊ $5\times3\times\frac{9}{16}$ and $\frac{7}{16}$ under engines and boilers—distance apart at centres 18 ins. Keel, *dimensions* 10×4 in. Stem, 10×4 in. tapering to 8×2 in. Stern posts, *inner*, below shafts 12×4 in., above shaft 10×4 in., *outer* 8×6 in., tapering to 8×3 in.

Abut joints and double riveted—Strakes, clincher laid and double riveted to 6 feet water line. Floor plates connecting frames, 20 inches deep at keelson and $\frac{1}{2}$ inch thick.

Bulk heads—Four, water-tight, of $\frac{1}{2}$ to $\frac{3}{8}$ in.; plates stiffened by angle iron ⌉ $4\times3\times\frac{3}{8}$ in. placed vertically two feet a part.

Coal bunkers—of $\frac{3}{8}$ and $\frac{3}{16}$ in. Plates, stiffened with angle iron ⌉ $3\frac{1}{2}\times3\times\frac{3}{8}$ in. placed 2 feet 6 inches apart; ceiled over floors with $\frac{3}{16}$th plates.

Deck plank, *upper*, East India teak 3 in. thick; *main and lower*, yellow pine 3 in.

Speed, 12·56 knots, with and against tide. Hull ceiled to 4 feet water line with elm, 3 inches thick. C. H. H.

For the Journal of the Franklin Institute.

Particulars of the Steamboat Acorn.

Hull built by Capes and Allison, Hoboken. Machinery by Hogg & Delamater, New York. Intended service, Boston and Sandwich.

Hull.—			
Length on deck, from fore part of stem to after part of stern post,		120 feet.	
Breadth of beam at midship section, above the main wales,		22 "	
Depth of hold,		7 "	
Draft of water at load line,		7 "	6 inches.
" " " below pressure and revolutions,		7 "	6 "
Masts and rig,	Three masted schooner.		
Engine.—Vertical direct.			
Diameter of cylinder,			26 inches.
Length of stroke,		2 feet	2 "
Maximum pressure of steam in pounds,	40.		
Maximum revolutions per minute,	60.		
Weight of engine,	15 tons.		
Boiler.—One—return flued.			
Length of boiler,		18 feet.	
Breadth "		6 "	6 inches.
Height " exclusive of steam chimney,		7 "	6 "
Weight " without water,	$7\frac{1}{2}$ tons.		
Number of furnaces,	one		
Length of grate bars,		5 feet	8 inches.
Number of flues or tubes,	13.		
Internal diameter of flues or tubes,	9 of $8\frac{1}{2}$ ins., 4 of 13 ins.		
Diameter of smoke pipes,			28 inches.
Height, " "		20 feet.	
Description of coal,	Anthracite.		
Draft,	Natural.		
Consumption of coal per hour,	$\frac{1}{4}$ ton.		
Propeller.—			
Diameter of screw,		8 feet.	
Length of blades,		2 "	3 inches.
Pitch of screw,		18 "	
Number of blades,	4.		

Remarks.—Floors filled in solid under engine. C. H. H.

For the Journal of the Franklin Institute.

Reply to T. Ewbank's Thoughts on the Caloric Engine. By John H. Bloodgood, Esq.

In looking over the September number of the *Journal of the Franklin Institute*, I find an article headed "Thoughts on the Caloric Engine," which, as it is the last of a series of articles which have appeared from time to time from various sources, and almost the only one which essays to meet the subject upon philosophical grounds, instead of by ridicule, merits a reply.

In the article referred to, Mr. Ewbank commences his argument with the assertion that the claims in behalf of the caloric engine necessarily

demand the rejection of previously received theories of heat, in its connexion with power.

Were this so, which I do not admit, it appears to me no sufficient argument against; for a theory, at best, is but an ingenious invention of the mind to explain certain natural phenomena, and liable to be overthrown at any time, should it be found insufficient, under more critical investigation. If facts cannot be reconciled with theory, the latter, and not the former, must give way.

But is it the fact that the principles of this engine are at variance with received theories? Mr. Ewbank states that Capt. Ericsson and his friends claim that, "but for practical difficulties and imperfections attending the construction of a new class of machines, the *whole* heat might be saved from running to waste."

I have known Capt. E., personally, and have often talked with him upon this subject, but have never heard him claim this much; on the contrary, he *positively and most emphatically disclaims* any such idea. What his friends claim, may arise from their misapprehension, but certainly not from his own assertions. He has never, to my knowledge, claimed to retain for future use, *any heat* but that which *has not been expended* in useful effect, (or whose force has not been transferred to matter outside the engine.) The value of this quantity may be variously estimated by different experimenters; for myself, I am fully convinced that the actual force exerted by the best form of steam engine, is very far from expressing the total force existing in the elastic fluid under the given temperature, or the total power of the caloric. Indeed, no body through which a power is exerted, can communicate its *whole* force to another body, except it lose entirely its own motion; and we know that there is still much force remaining in steam on its exit, since it is evidently capable of expansion until it is in equilibrium with the resistance offered by the air, or the smaller resistance of the condenser; and even after this expansion, there still remains heat enough to cause considerable increase of bulk with useful effect in any gas or other matter with which it might be mixed. We have, therefore, certainly lost some part of the value of the heat; and it is this heat, (which has ordinarily to be renewed, together with that actually expended in useful labor,) and *only this*, which Capt. E. expects, or has claimed to save. How much this may amount to, or what may be its mechanical equivalent, I do not now propose to discuss.

It will not, however, be out of place in this connexion, to quote the words of the celebrated Regnault, certainly the highest authority on the subject of caloric now living, to wit: "In air engines, when the motive force is produced by the dilatation which heat produces upon gas in the machine, or by the increase which it produces in its elastic force, the work done at each stroke of the piston will always be proportional to the difference of the quantities of heat in the air entering and leaving; that is to say, the loss of heat by the air in traversing the machine." But, as in the Ericsson system, *the heat which the air gives out, is given up to bodies from which the entering air takes it again, and brings it back to the machine*, we see that, theoretically, *all the heat expended is utilized for*

mechanical work; whilst, in the best steam engine, the heat utilized in mechanical work is not the one-twentieth part of the heat expended.

In physics, a well-known rule holds, that inelastic bodies in motion striking against others, will communicate a force proportioned to their relative momenta; and, when the two are of equal weight, one being at rest, the striking body will yield half its motion to the other, and retain an equal amount. A similar law, with certain limitations, seems to hold good in the transfer of heat from one body to another, so that, as is well known, heat may be *almost*, but *not entirely*, withdrawn from any body by successive contact with cooler matter.

To illustrate my meaning, and its application to the return of heat for useful purposes, let us imagine a series of cups, say ten, placed between two vessels of water, one heated to 200°, the other standing at 50°; let each cup be half filled with water at 50°; then, beginning at the end nearest the hot vessel, fill the cup from that vessel, the quantity required to do this being equal to that already in the cup, the temperature resulting from the mixture will be 125°; again, from this fill the next, it will produce a common temperature of 87·5°, and so on until the last, when the temperature of the water in that cup will not be raised more than the fraction of a degree. If we reverse the operation, taking cold water (at 50°) to begin with, we will find that, on arriving at the hot vessel, it has acquired the temperature of 100°; and if the process be frequently repeated, the gain in one direction, and the loss in the other, will finally reach a constant ratio, resulting in a higher temperature in the water returning to the hot vessel, constantly approaching the degree of heat in that vessel, as the series of cups is extended, *but never equalling it.* Heat, therefore, is obviously capable of return to a great extent, or of being saved; nor would the result be altered in the least, in this respect, were we to apply the expansion, in each successive vessel, to the movement of machinery.

Were we to substitute air for the water, causing it to impart its heat to successive equivalents of any kind of matter, we would obviously obtain an analogous result; and, as before, the return of the heat to a fresh portion, would be independent of any mechanical force exerted by the air, and would certainly be saved. Nor can this result be affected by the mechanical arrangements for freeing the air through the various parts, since the same devices, requiring the same power, will be necessary in simply supplying a reservoir with air to be directly heated by fire before entering the engine, and certainly no one will deny that a surplus of power *can* be thus obtained for moving machinery.

It cannot be denied, however, that in the use of permanent gases, the force consumed in renewing the supply, bears an inconveniently large proportion to the force available for other uses; and, next to the mechanical difficulties in the engines hitherto constructed, this has been made a point of objection most strongly urged by writers on this subject.

But to revert to our original proposition; does the return of heat, as illustrated above, imply a perpetual motion, as stated by Mr. Ewbank? Most certainly not; even were an engine constructed solely with reference to continued motion, without regard to any exertion of power. This plainly appears from what I have shown as the action of a "regenerator;"

for, though the saving may approach, apparently, very nearly the whole quantity of heat demanded, it certainly can never equal it, even leaving out of the consideration the effect of expansion, radiation, &c. Theoretically, it may approach infinitely near that point, but there must still be a difference.

If my assumption as to the value of heat returned be not admissible, how then can we account for an engine being kept in motion for a long period, an hour or more, after all sources of heat except the regenerator and heated parts of the engine have been removed? and this I assert to be a fact.

Mr. Ewbank also compares the force exerted by steam or heated air to that of lifting a weight by a counterpoise somewhat greater, or by animal force. The comparison, as stated, is not a proper one, since he loses sight of the fact that it is not the greater weight, viewed simply as a mass of matter, that lifts the other, but the more subtle force of gravity, a force which has been used over and over again from all eternity, and which bids fair to last as much longer. With regard to animal power, the analogy also fails on account of the new elements connected with vitality, whereby the contractile force of the muscles becomes exhausted; and, furthermore, we have no means of ascertaining what increase of combustion is necessary in the lungs (beyond what is required merely to sustain life,) to compensate for the exertion of power in doing any given amount of labor. Such forces as gravity, heat, or electricity, I conceive are indestructible in their very nature, and are only lost to our sense, by being, under certain circumstances, in a state of equilibrium, or balanced by opposite forces.

Finally, as to the statement that the regenerator acts as a serious drag on the engine, by resisting the passage of air, I have only to say that this exists only to a very trifling degree, for in an experiment which I witnessed to test this very fact, the obstruction in passing through 250 wire disks, was only sufficient to change the level of a mercury gauge about one-quarter of an inch, too inconsiderable to be of serious moment, compared to the whole power.

New York, October 6th, 1854.

For the Journal of the Franklin Institute.

The Caloric Engine. By J. Ericsson, Esq.

A very learned Professor of mathematics in the North of Europe, recently published a pamphlet in relation to this motor, in which he clearly demonstrated, that caloric cannot be made to exert an infinite amount of mechanical force. On presenting a copy of his work to an eminent engineer for his approbation, this gentleman returned civilities by presenting the Professor with a printed copy of the claims of the inventor, under which, several European patents had been granted. The *savant* was much mortified to learn by the document thus presented to him, that he had wasted time by disproving a proposition not advanced. This is only one instance out of hundreds, that might be cited, of uncalled-for criticism on this subject. Such misconceptions on the part of those who have

only had access to newspaper statements, popular lectures, &c., are by no means surprising. That Mr. Ewbank should have fallen into a similar error is, however, unaccountable; for he, as Commissioner of Patents, signed a document, in which the following distinct declaration of the inventor is contained: "whilst in the steam engine the caloric is constantly wasted by being passed into the condenser, or by being carried off into the atmosphere, in my improved engine, the caloric is employed over and over again, enabling me to dispense with combustibles, *excepting for the purpose of restoring the heat lost by the expansion of the acting medium, and that lost by radiation*, also, for the purpose of *making good* the small deficiency *unavoidable* in the transfer and retransfer of the caloric." In the face of so clear a statement, it is palpable injustice to attribute to the inventor, the absurd proposition of producing an unlimited amount of mechanical force by caloric. Moreover, an accurate estimate of the quantity of fuel requisite to meet the several sources of loss here distinctly pointed out as inseparable from the caloric engine, viz: the loss by radiation, the loss by fall of temperature during expansion, and loss attending the process of transfer in the regenerator, will, assuredly, not furnish good excuse for confounding the caloric engine with the chimera of "perpetual motion." At the same time, it may be readily proved, that the caloric, which is thus in part wasted, and in part rendered unfit for producing motive power in this engine, calls for but a small consumption of fuel. Accordingly, the production of a given amount of power will require but a small consumption compared with the present steam engine.

Mr. Ewbank states that heat cannot be used over again. It has been shown by the practical working of several caloric engines, that the quantity of heat contained in the air of the working cylinder is much greater than the quantity generated by the combustion in the furnaces during each stroke. The excess, therefore, must be supplied by the regenerator, which receives its caloric solely from the air escaping from the working cylinder. It would be sheer sophistry to say that this is not employing heat over again. Treating heat as motion only, and adopting corresponding language, would render the explanation of the operation of the machine quite unintelligible. Otherwise, the writer has no objection to deal with caloric as force, for his opportunities of observing its nature and effects, have been most extensive, and he long ago arrived at the conclusion, that heat is motion. The superficial investigator alone, will deem this hypothesis fatal to the caloric engine. A thorough investigation of the principle of the engine will show, that (supposing *caloric* and *motion* synonymous,) the proposition is not to reproduce the motion once imparted, or parted with, but simply to employ, or exhaust, the whole motion, the entire force resulting from the exciting cause. How imperfectly this is accomplished in the present steam engine, needs not be pointed out, *high* and *low* temperature being alike unavailable, whilst in the caloric engine the exciting energy, the force of caloric, may be rendered available from 540° down to atmospheric temperature.

Mr. Ewbank's practical mode of illustrating the subject by showing that "there is no making pounds out of pennies in the currency of force," calls for the following kindred illustration: The force of caloric being

represented by a stream of water running down a declivity of a certain height, the present steam engine will be truthfully represented by a small overshot wheel placed somewhere down the stream; the caloric engine, at the same time, will be as truthfully represented by a Turbine wheel placed at the bottom, employing the force of the entire height of the fall. The wheel first mentioned, has been tinkered at for half a century, and at last rendered tolerably perfect, its admirers telling us with exultation, that "it spans the entire stream, and that not a drop can pass without doing full duty." They forget, in their admiration, that the stream is running to waste above and below.

The writer desires to be clearly understood to assert, that the power developed by the caloric engine, demands no further consumption of fuel than that requisite to meet the several sources of loss of heat enumerated in the foregoing statement, viz: fall of temperature by expansion of the acting medium in the working cylinder, radiation of heat, and loss attending the process of transfer of the caloric in the regenerator. The first named loss, calculation will determine; the other two have been ascertained experimentally. The result establishes a very small consumption of fuel compared with the present steam engine. The saving is effected mainly, by using the heat over again in the regenerator, *by which*, in every instance, the air entering the working cylinder has been elevated to 400°, often as high as 500°, *before receiving any heat from the furnaces.*

New York, October 9, 1854.

Remarks by the Editor.—We publish the remarks of Messrs. Ericsson and Bloodgood, although it is rather too late to begin to reply to the articles previously published, after the total failure of the project. Nor do we agree with the gentlemen as to the view they take of the question. Mr. Bloodgood incorrectly asserts that Mr. Ewbank's article is "almost the only one which essays to meet the subject upon philosophical grounds, instead of by ridicule." The ridicule which was thrown upon the project in some of the later articles which have appeared in this *Journal*, was caused by the attempts of his friends (for we considered the feasted and champagned reporters who were permitted to attend his trip, in this light,) to present each successive failure as an entire success. The principle, as announced in the patent, was fairly developed and rationally discussed in former articles, to which no reply was attempted.

We do not accuse Mr. Ericsson of having ever asserted that his engine was, in principle, a perpetual motion. But this claim was decidedly and frequently made in the various newspaper articles which reported his banquets, and for which we cannot but consider him responsible, since they were published under his auspices, (on his account, as it were,) and without public remonstrance on his part, so far as we have ever heard.

The experiment we always regarded as an interesting one, and regretted the care with which all impartial and competent men were excluded from an opportunity of witnessing the trials. Now, that the result has been a complete failure, it is, we imagine, useless to resume the discussion, until new features are developed in the machine, or capitalists are found ready to throw away their money on a new experiment.

For the Journal of the Franklin Institute.

Particulars of an Iron Steam Barge.

Hull built by Reaney, Neaffie & Co.; machinery by the same. Owners, Baltimore and Philadelphia Steamboat Company. Intended service, freighting between Baltimore and Philadelphia.

HULL.—			
Length on deck,		148 feet.	
Breadth of beam,		23 "	
Depth of hold,		8 "	
Contents of bunkers in tons of coal,	10		
Masts, two, to be used as derricks for taking in cargo.			
ENGINES.—One.—Direct acting, inverted cylinder.			
Diameter of cylinder,			28 inches.
Length of stroke,			26 "
Maximum pressure of steam in pounds per sq. in.,	80		
Cut-off from commencement of stroke,	13		
Weight of engines in pounds, estimated,	29,000		
BOILERS.—One.—Flue and return flue.			
Length of boiler,		20 feet	6 inches.
Breadth "		6 "	6 "
Height " exclusive of steam drum,		7 "	9 "
Cubic feet of steam drum,	225		
Weight of boilers in lbs., with water, estimated,	32,000		
Number of furnaces,	2		
Breadth of furnaces,		3 "	
Length of grate bars,		5 "	6 "
Heating surface,		700 square feet.	
Consumption of coal per hour, estimated,	336 lbs.		
PROPELLERS.—			
Diameter,		8 feet	1 inch.
Length of blades,		2 "	8 "
Depth "		15 "	
Number "	4		
Average revolutions per minute, estimated,	75		

Remarks.—Frames, $\frac{3}{4} \times 3\frac{1}{2}$ inches, and 15 and 18 inches apart; 7 strakes of plates from keel to gunwale; thickness of plates $\frac{3}{8}$ and $\frac{1}{4}$.

W. J.

For the Journal of the Franklin Institute.

Steamboat Explosions.

Whenever we have an account of a boiler explosion, we hear the cry for a week or so for new laws, and more stringent provisions, careful inspection, &c., &c., and the General, State, and Municipal Governments are in turn solicited for their interference, and abused for their negligence, until the epidemic excitement has run its course in a few days, and all the clamor subsides, to be re-awakened by a new catastrophe. How far we want new laws, or how far the present regulations are available, may, we think, be gathered by glancing at the result of the examination of an engineer of a Mississippi boat which exploded, killing, in the opinion of the captain, from eighteen to twenty persons.

The character of the explosion may be collected from the subjoined testimony of the Captain, and the Government Inspector:

"*September*, 1854.

"EDMUND F. DIX, sworn on the part and behalf of the United States, says: That he was Captain or Master of the steamer *Timour*, No. 2, on the 26th day of August, 1854, and at the time of the explosion of the boilers of said steamer, about three miles below Jefferson City, on the Missouri river. The explosion took place between 10 and 11 o'clock, A. M., of the said day; after I had landed the boat, I walked down to the boiler deck; I had been there probably half a minute when the boilers exploded; the next place I found myself was on the forecastle; all three of the boilers exploded, and the decks were broken down; I heard one tremendous crash at the time of the explosion, and that was all that I recollect of hearing; everything that I saw about the boat afterward, seemed to be dry, and the persons injured seemed to be burnt rather than scalded; I had not noticed anything unusual in the condition of the steam on the boat; there had been no extra exertions to increase the steam, previous to the explosion, to my knowledge; from the time of the landing of the boat up to the explosion, it could not have been more than three minutes; my opinion is, that there were from eighteen to twenty persons killed by the explosion; I noticed a piece of the boiler on the side of the hill, one hundred and fifty or two hundred yards from where the boat was lying; I have been steamboating for fifteen years; from my experience and observation, such as it is, I have formed the opinion that the explosion was caused by want of water in the boilers.

"*Cross-Examined* by Captain Hudson.—There was no unusual head of steam at or up to the time of the explosion; the boilers of the *Timour* had been in use about three years; all of the boilers were at one time so much burnt that one sheet had to be taken out of each of them, and new sheets put in; this burning was caused by there being very little water in the boilers; at another time, one of the boilers was heated in the same way, so that the sheet had to be taken out; one of the boilers might be so burned without affecting the others; Mr. M'Cord and Mr. Scott, the persons who are now under examination here, were the two engineers on the boat at the time of the explosion; Mr. M'Cord had the reputation of being a careful man; I did not know Mr. Scott until he came on the boat as second engineer.

"Being *re-examined*, says: That the boilers were inspected once by the Government Inspectors since the last burning above spoken of took place, and at the time of repairing the said burns, all the injured portions were removed.

"(Signed,) Capt. E. F. DIX."

"DAVIS EMBREE, sworn, says: In the performance of my duties as Supervising Inspector of Steamboats, I went to the wreck of the *Timour*, No. 2, near Jefferson City, Missouri, to make a personal examination; all the boilers, three in number, had exploded; the main deck of the boat, from the forward boiler beam to the cylinder timbers, a space of about thirty feet, was completely broken; the plank shears and guards for that length were also broken or blown overboard; the lattice bulkhead and string piece that supported the beams were also broken away, and I have reason to suppose that some of the planks of the hull were blown off, as it is in evidence that the boat sunk immediately; it is shown that nearly the whole force of the explosion was upwards and downwards; the main deck, cabin floor, hurricane deck, and officers' rooms, (Texas,) were all cut off nearly even with the cylinder timbers, or only a few feet back of where the boilers stood; the forward part of the boiler deck, part of the hurricane deck, and the chimneys, I am informed, were thrown upon the forecastle; the decks, beams, cabins, and every part of the wood work under and over the boilers, appear to be literally broken up into splinters; parts of some of the boilers and flues are scattered about the shore and deck; some pieces of the flues are flattened, and others are not so; the after-head of the starboard boiler lies upon the deck between the cylinder timbers, with parts of the flues and more than one ring of the boilers attached; the forward heads of the boilers being of cast iron, are much broken; the flues of the middle boiler, with part of the after-head attached, are across the boat near the cylinder timbers, the one pointing to the shore, and the other into the river. Part of the after-head of the larboard boiler is on shore, with some of the shell attached; two large fragments of this boiler were thrown upon the bluff, equal to about six sheets, and weighing, by estimate, 450 pounds. It struck a tree, as near as could be judged, 200 feet in height, and in a horizontal direction, 160 yards from the boat; the other, which would weigh about 150 pounds, was 20 or 30 feet nearer the

boat; one large fragment of iron, containing about the equivalent of four sheets, was in the hold of the boat; it had been torn open at the bottom of the boiler; all the large fragments examined, with one exception, were also torn open at the bottom of the boilers; the stand pipes were broken short off at the cross or supply pipe; the mud receivers and safety valve were not found; the doctor was overset, but not broken; the valves were all examined, and found in good order; the heavy line scales were generally thrown off of the iron where there was a flattening of flues, or straightening of the shell; but on some parts of the bottom of the shell of the boilers, I found heavy lime scales, which I judge to be between one-eighth and three-sixteenths of an inch thick; these were what we steamboatmen called low-water scales; the flues that were not flattened were heavily coated with lime. I saw no water line, or mark of low water on the flues, or on the head of the boiler on the deck of the boat. I suppose if the water had been low in the boilers, the lime scales in the tops of the flues would have shown it; but I heated a part of a flue that was heavily coated with lime until it burnt a wad of wet hemp to ashes, and it appeared to have no effect upon the lime scales. The lime seems to adhere to the iron as paint does to wood; this is the low-water lime scale; the high-water lime scale is more rough and porous. I brought away some pieces of the iron of the exploded boilers, but have not yet had time to have its strength tested. I have the promise of the exact height and distance from the boat to where the fragment of iron struck the tree, by the Superintendent of the Pacific Railroad.

"From the facts in evidence in this case, we must draw our conclusions as to the cause of this melancholy disaster. It is an extraordinary occurrence, the time being just after stopping the boat, is unusual; had it occurred on starting the boat, after it had been lying some time at shore, we might attribute it to the accumulation of surcharged or unsaturated steam, as fully treated upon in the *Western Boatman;* to the adhering of the safety valve by glutinous matter, or to some other such cause; but in this case there was not time to accumulate an undue head of steam, if the evidence be true. There was no evidence of a want of water, unless the fact that there was an explosion be that evidence, which I cannot admit in all cases; although I admit it is the general cause of explosions. In this case there is direct and positive testimony of there having been plenty of water in the boilers. This is supported by the fact that there was not a person on board, be his experience great or otherwise, that noticed any change or variation in the sound of the steam whatever; they were all as unconscious of danger as we are now, sitting in this room; we must, therefore, look to some other cause for the event. I cannot agree with the witness, Chappell, that it was an instantaneous and unaccountable accumulation of power; if so, steam is not under human control, even for ordinary purposes. Every effort should be made, and every faculty of the human mind exerted to its utmost tension, before we come to such conclusion. First, then, is there any necessity for looking for greater force than is admitted to have existed in the boilers of the *Timour*, No. 2, at the time of the explosion, to account for all the results that followed? There were three boilers, each 28 feet long, and 40 inches in diameter, with a pressure of 150 pounds to the square inch; 40 inches in diameter is 120 inches in circumference; 28 feet is 336 inches in length; these, being multiplied, make 42,000 square inches; multiplied by 150 pounds to the square inch, makes 6,300,000 pounds for one boiler, and for three boilers makes 18,900,000 pounds, or 9450 tons. There were, then, 9450 tons of pressure chained within the boilers of the *Timour*, at the time of her landing. If we can show that this tremendous force was instantaneously let loose upon the deck of the boat, will it not account for all that we have seen? If we deduct the one-half, three-fourths, or even eight-ninths of this force, as having escaped sideways and endways, we have yet more than a thousand tons of direct force to mash the deck of the boat to atoms, and send fragments of the boiler 200 feet high and 160 yards horizontally. That the boilers of the *Timour* did split open at their bottom, is evidenced by the force of the steam having operated upward and downward, and not endwards to any great extent; that the explosion was almost instantaneous, is gathered from the fact that most of the persons on board recollected but one tremendous shock, while others think there were two shocks or concussions. The latter I think probable, and that the middle boiler first gave way. It would in that case drive the others outward, and tear them from the fastenings to the mud-receiver and cross-pipe. When the boilers were thus fractured, they may have torn from end to end in a single instant, because the whole force of the steam in that direction would be applied to break fibre after fibre, like the tearing of cloth, thread by thread, making no difference with what speed it would be effected. I draw this conclusion from the direction in which the large fragments of the larboard boiler were thrown upon the bluff, while the starboard boiler, with the exception of the after-head, was probably

thrown into the river. The shell of the middle boiler was thrown, no one knows where, while the flues of it were thrown in opposite directions, and now remain fast to part of the after-head, upon the boat. These things indicate an almost exact upward and downward tendency of the force, and a balancing of the materials upon which it operated; I therefore believe that the cause of the explosion was the injury of the iron of the bottoms of the boilers by being covered with lime, a partial non-conductor of heat; the iron when thus exposed has the fibre destroyed, and becomes granulated or crystallized and weakened, and that the boilers give way in the weakest part.

"*Cross-Examined.*—States that the quantity of steam allowed on the steamer *Timour*, No. 2. was 150 pounds to the square inch, as appears by the certificate of Inspectors; the boilers on this boat were one grade thinner than usual, though not so thin as many that have passed inspection; I profess to be an engineer, though never acted regularly in that capacity on a steamboat; it is some ten or twelve years since I have been on the river as boatman at all; I never was engaged in boating on the Missouri river; boilers used on the Missouri river are more liable to be injured or affected by lime scales than other waters with which I am acquainted; scales will constantly be forming in navigating the Missouri river, unless there be some remedy applied to prevent it; the giving away of the boilers, or any one of them, in any portion or part, with the usual head of steam, might have produced an explosion, and the appearance of the wreck just the same as made by the explosion in this case.

"(Signed,) DAVIS EMBREE."

To show the competency of the men employed, we have the testimony of an assistant engineer, that—

"I do not believe that the explosion took place from a gradual increase of pressure, but from an instantaneous pressure *caused by some means which has never been discovered.*" "I do not think it possible for any gradual increase of steam to have torn a set of boilers into so *many irregular shaped fragments.*"

On the strength of this evidence, the U. S. Commissioner decided to discharge the defendants, "the said evidence not being sufficient to show that they or either of them were guilty of inattention, negligence, or misconduct, in the discharge of their duties."

What use, then, of making laws, the administration of which is to result in such a solemn farce? If these engineers were not guilty, then what must an engineer do or neglect, in order to convince the Commissioner of his guilt?

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*Vulcanized Stone.**

A fresh invention has been patented for hardening the soft stones of the country. Specimens have been exhibited of great hardness, susceptible of high polish, which preserve a sharp arris, and are stated to be proof against the alternations of our climate, and to withstand not only the London atmosphere, but even the action of the strongest acids. The proprietors allege that, by a solution, chemically prepared, and laid on with a brush in dry weather, the decay of old buildings may be arrested; and the material acted on, whether stone, compo, or brick, be made perfectly non-absorbent.

The specification says,—"It is proposed (in all cases where it is practicable) in applying any indurating mixtures, to inclose the stone or other materials to be operated upon in an air tight chamber, and exhaust, or partially exhaust, the same, and then allow the indurating substance, whether hot or cold, to trickle down, or flow into the chamber, to fill the vacuum, the effect of which will be that the liquid indurating substance will readily find its way into the pores of the stone or other material, and become incorporated therewith.

* From the London Builder, No. 576.

Mixture No. 1.—The composition of this solution is as follows:—56 parts, by weight, of sulphur, dissolved by the aid of steam heat, or dry heat, in 44 parts dilute vinegar, or acetic acid containing 17 parts of acid to 8 of water.

In preparing indurating mixtures to be applied to the exteriors and interiors of buildings, whether possessing a surface of brick, stone, cement, or plaster, I employ the following ingredients:—Shellac, 14 parts, by weight; seed lac, 14 parts; coarse turpentine, one part; pyroligneous spirit, 40 parts;"—and other mixtures.

For the Journal of the Franklin Institute.

Particulars of the Steamer Plymouth Rock.

Hull built by J. Simonson, New York; machinery by Allaire Works. Owners, New Jersey Transportation Company. Intended service, New York and Stonington.

HULL.—		
Length on deck,	330 feet.	
Breadth of beam at midship section, (moulded,)	40 "	
Depth of hold,	12 "	8 inches.
Draft of water at deep load line,	6 "	
Masts and rig, none.		
ENGINES.		
Diameter of cylinders,		76 inches.
Length of stroke,	12 feet.	
BOILERS.—Two.		
Length of boilers,	38 feet.	
Breadth "	12 "	6 inches.
Height " exclusive of steam chimney,	11 "	8 "
Number of furnaces,	4	
Length of grate bars,	8 "	
Number of flues or tubes,	13	
Length " "	24 and 30 "	
Diameter of smoke pipes,	5 "	
Description of coal,	Anthracite.	
Draft,	Blast.	
PADDLE WHEELS.		
Diameter,	37 feet.	
Length of blades,	10 "	
Depth "	2 "	6 inches.
Number "	30	

Remarks.—Boilers on guards; Hull strapped with iron; Floor timbers moulded 18 inches; sided 7 and 10 inches, and set 24 inches apart at centres.

C. H. H.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, October 19, 1854.

George W. Conarroe, President, pro tem., in the chair.
John F. Frazer, Treasurer.
Isaac B. Garrigues, Recording Secretary.

The minutes of the last meeting were read and approved.

A letter was read from W. H. Shock, Esq., U. S. N.

Donations to the Library were received from Prof. A. D. Bache, U. S. Coast Survey; Messrs. Blanchard & Lea, Lindsay & Blakiston, and Prof. J. A. Kirkpatrick, Philadelphia.

Donations to the Cabinets—from W. H. Shock, Esq., Chf. Eng., U. S. N., and Andrew R. Dietz, Esq., of St. Thomas, West Indies.

The periodicals received in exchange for the Journal of the Institute were laid on the table.

The Treasurer read his statement of the receipts and payments for September.

The Board of Managers reported the following resolutions, passed at their last meeting:

Resolved, That it is with extreme sorrow that the Board have learned the death of their late colleague, Dr. Robert M. Patterson, whose devotion to the cause of science and its applications, rendered him for many years one of the most active members of the Franklin Institute, and entitled him to the respect of all who desired the promotion of the Mechanic Arts.

Resolved, That endeared as he was to his associates by his amiable manners and the kindly interest which he manifested in encouraging others in the pursuits to which he was devoted, the Board take a melancholy pleasure in expressing their high estimation of one whom they loved for his virtues no less than they admired him for his talents.

Resolved, That the Chairman be requested to transmit a copy of these resolutions to his family, in token of our sympathy with their affliction, and as a testimonial of the regard in which we hold the memory of the deceased.

The Standing Committees reported their minutes.

New candidates for membership in the Institute (21) were proposed, and the candidates (4) proposed at the last meeting, were duly elected.

Mr. Fairman Rogers laid before the members of the Institute several photographs taken in Paris from public buildings; they are by the collodion process, and remarkable from their great size and perfection.

Also, a Geological Map of Belgium in sheets, just published in Liége, from surveys by Prof. Dumont, of the University of Liége. It is a very beautiful work, and bears evidence of the amount of care and labor bestowed upon it.

Mr. R. also exhibited a railroad reading lamp, which is made for the convenience of the English traveler, consisting of a small copper lantern, well silvered inside, and japanned on the outside, with a glass front and long candle case, with the usual spring socket, which slides into the lantern when not in use, and is very portable. It is designed to be attached by hooks to the cloth lining of the coach.

Also, a surveying instrument, the invention of Capt. Bournier, of the French army. It consists of a compass-needle, carrying a silver disk, the graduations of which are read through an eye-piece in the front of the instrument; above this disk, and on the same centre, another, which is loaded on one side, causing the diameter, which passes through the 90° division, to assume a vertical position. The sights are the same as those of an azimuth compass, and the whole instrument is very portable, being only 4″ long, by 3″ wide, and 1″ deep. It may be used in the hand or fastened on a walking stick, and gives quite accurate results for magnetic bearings, levels, or vertical angles.

JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS.

DECEMBER, 1854.

CIVIL ENGINEERING.

On the Retardation and Stoppage of Railway Trains. By Mr. William Fairbairn.*

The general principle of railway carriage brakes, namely, that of retarding or stopping the revolution of the wheels by the pressure of brake-blocks against their peripheries, is limited in its application to the single carriage in which the power is applied by the guard's hand; and looking at the present greatly increased velocities of trains, and their probable acceleration, it becomes a very important question, whether some more powerful and speedy control is not required over the motion of the train than can be obtained by the ordinary plan of a brake upon one or two guards' vanes, and upon the tender.

Many plans have been proposed, during the progress of the railway system, for the accomplishment of this desirable object; and amongst them may be mentioned, as one of the most practical, a plan invented some years since by Mr. Robert Heath, of Moss-side, near Manchester, which consisted of brake-blocks fixed in slide-bars in each carriage, and worked by a lever with a weight upon the end of it, adjusted to give the requisite pressure upon the wheels. When the pressure of the brakes was required to be taken off, the ends of the levers were lifted by means of a tension-bar and chains, which extended the whole length of the train, and were worked by a rack and pinion within reach of the guard. The

* From Newton's Lond. Journal and Repertory of Arts and Sciences, Aug. 1854.

peculiar feature in this brake, distinguishing it from the ordinary hand-brakes, was the employment of a weight to put on the pressure of the brakes, independently of the power of the man's hand, and simultaneously in every carriage of the train,—giving an important advantage in the great increase of power available for stopping the train, and the promptness of its action; the guard having only to release a catch in order to put on all the brakes at once, and employing his own power only in lifting off the brakes afterwards, by means of the rod and chain communicating with each carriage. In a practical trial of these brakes, in 1848, with a train of five carriages and a van, all fitted with the brakes acting together, and the tender-brake also used, the following results appear to have been obtained:

Speed of Train when Brakes were applied.	Descending gradient.	Distance run after Brakes were applied.
40 miles per hour.	1 in 100	148 yards.
45 " "	1 in 100	163 "
50 " "	1 in 82	232 "
55 " "	1 in 200	264 "

Numerous other plans have been suggested, and tried at different times, for the purpose of arresting the motion of railway-trains within shorter distances than can be effected by the ordinary hand-brakes; but none of them appear to have answered the purpose satisfactorily, or effected any material change in the brakes in general use.

The next improvement requiring particular notice, is the brake recently invented by Mr. James Newall, of Bury,—the more immediate subject of the present paper.

The immense extension of railway communication, and the number of persons conveyed, involve considerations of such vast importance, as to render any attempt to obtain increased security a subject of deep interest, in whatever form or direction that security can be effected. If the causes of the railway accidents which from time to time take place are considered, they may, in many instances, be traced to the inability to bring a train from a state of motion to a state of rest; or, in other words, to the inability to absorb the momentum of the train within a given distance of space, without injury to the carriages, or endangering the safety of the passengers. This has always been a defect in railway traveling, and many of the serious accidents arising from collisions have occurred, from the want of power to stop the train in motion before it arrived at the point of contact.

This, to some extent, has been accomplished by Mr. Newall's brake; and from the results of the experiments made on the East Lancashire railway, on the 7th of November last, as described subsequently, this brake appears to bid fair to accomplish that object, or at all events to become the precursor of further improvements, giving increased security to railway traveling.

The paper contained a detailed account of Mr. Newall's apparatus; but his specification having recently appeared in this Journal (vol. LXIV, p. 31,) we have thought it unnecessary to repeat this description.

The following are the objects obtained by this brake :—1st. A direct communication between the engine-driver and the guard ; which communication is always available by either party, in the event of a sudden and unexpected discovery of danger, or obstruction upon the line: this is accomplished, not by ringing a bell or blowing a whistle, where time is lost before the brake can be applied, but by an instantaneous application of the brake itself, or rather, the whole of the brakes, which in every case is the first intimation of the presence of danger, and the remedy to avert its occurrence. This appears to be an important feature in the plan: it is easy of application, and probably the best signal that can be made between two officers of such responsibility as the driver and guard. In the experimental trial of this brake, this was an important feature, and one that could not be mistaken at the moment the brakes were liberated. The check (it could not be called a shock) was so distinctly felt, as to arouse the attention of less vigilant persons than guards and drivers, who are, or should be, constantly on the look-out. 2d. The instantaneous and simultaneous application of the brake to every carriage in the train, and the immediate application of a retarding power to a body of such magnitude as a train in motion, and that without endangering its security, is an advantage of great importance in this plan. The brakes are not screwed against the peripheries of the wheels, as is done in the usual way by the guard in the carriages, and the fireman on the tender ; but the whole of the brakes (even if 30 in number) are dropped at once upon the wheels, and, by the expanding force of the springs in the vertical tubes, the effect is such as to act as a signal from the driver to the guard, or, *vice versa*, from him to the driver. No time, therefore, is lost; and the retarding force is in operation upon every carriage at one and the same time; and, by this operation, a few seconds only are required to reduce the velocity and absorb a considerable portion of the momentum of the train. This simultaneous action is therefore of the utmost importance, particularly in the event of a threatened collision, which by this means, if not totally averted, will assuredly be greatly mitigated in its effects. 3d. The power which either the engine-driver or the guard have, together or separately, to sledge the train, or to increase or diminish the pressure on the brakes. In applying this plan of brakes to a railway train, particular care is required, in the first instance, when the train is marshalled, to regulate and adjust the brakes upon each carriage, so as to give neither more nor less than the required pressure. This it will be observed is a constant quantity; and the remaining pressure, when required, must be applied by the driver or guard ; and as time is an element in this application, there is the less danger of its being injuriously applied, even when extended to the limit of sledging the train, or stopping all the wheels. This power of application is, however, necessary, as the same amount of friction could not be applied with security to the train by the force of the spring, without incurring risk in the breakage of the wheels or axles.

The following are the particulars of the experiments made upon the East Lancashire Railway, to ascertain the retarding power of Mr. Newall's brake, in stopping railway trains: the train in each case consisting

of 10 carriages, besides the engine and tender, with a gross weight of 88 tons, including the engine and tender.

No. of Experiment.	Descending Gradient.	Speed of Train when Brakes were applied.	Distance run after Brakes were applied.	Remarks.
1	1 in 532	38 miles per hour	218 yards	Rails moist and slippery
2	Level	33 " "	100 "	Bury, rather doubtful
3	1 in 38	45 " "	430 "	Accrington Incline
4	1 in 40	48 " "	371 "	Ditto ditto
5	Level	48 " "	192 "	Blackburn, 2 wheels sledged
6	Level	40 " "	138 "	Ditto, 5 ditto
7	Level	50 " "	310 "	Ditto
8	Level	42 " "	620 "	Blackburn, 3 wheels sledged
9	Level	40 " "	800 "	Ditto

The experiments 1 to 7, were made with eight of the carriages in the train fitted with Newall's brake, besides the ordinary tender brake; and the experiments 8 and 9, were made with ordinary brakes,—two carriages being fitted with them in No. 8, and one in No. 9.

In the experiments 5 to 9, more particular care was taken to ascertain the speed by time and distance; and the moment at which the brakes were to be applied was marked more definitely by the explosion of a detonating signal at the point fixed.

The general result of these experiments appears very favorable to Mr. Newall's brake, as to the efficiency of its retarding power compared with those in ordinary use. At 40 miles an hour, upon a level, with the improved brake, the train was brought up in a distance of 138 yards; but with the ordinary brakes, at 42 miles an hour, 620 yards were run over before the train could be stopped; or, in other words, a railway train can be stopped in one-fourth the distance.

Another plan has been proposed by Mr. Samuel Newton, of Stockport, for attaining the same object of putting on the brakes in the train by self-acting means. To accomplish this, a friction-wheel, $2\frac{1}{2}$ feet in diameter, and 10 inches broad, is fixed on the centre of each axle: this friction wheel is surrounded with an ordinary clamp brake, such as is generally used in connexion with cranes, consisting of an expanding steel ring, lined internally with wood. One end of this brake-ring is fixed to the carriage frame, and to the other end is attached the short arm of a lever; so that when the long arm of the lever is raised, the ring is by this motion enlarged a little in diameter, to allow the friction-wheel to revolve within it without being touched. The long arm of the lever from the front axle approaches that from the hind axle, and both meet under the centre of the carriage: here the levers are joined by a bolt with a slide, so that they may rise and fall together. A weight is then attached; the tendency of which is to depress both levers, and to cause their respective short arms to collapse each brake-ring tightly round the friction-wheel, and thus arrest its revolution, and with it that of the axle and wheels. This is proposed to be the arrangement for every carriage; the weight

on the levers between each pair of wheels being about 120 lbs. By force of gravity, the brakes will apply themselves; and the power to be exerted must be for the purpose of taking them off. This is proposed to be done by the pull of the engine, by means of a metal rod with joints, which passes under all the carriages in a train, and is placed in connexion with the weighted levers. The first end of this rod is to be joined to the tender; and when the engine starts, it will draw out the rod so as to lift up all the levers, and thus release the brakes from the friction-wheels, and keep them clear, so long as the engine continues its tension upon the draw-bar. By this arrangement it is contemplated by the inventor, that, in order to stop the train, it will simply be necessary to arrest the speed of the engine, and the draw-bar will then slide backwards by the action of the weights, which will at the same time depress the levers and apply the brakes.

In another plan for accomplishing a similar object, recently proposed by Mr. Alfred Molson, of London, the application of the brakes is proposed to be effected by means of a brake-bar sliding longitudinally under each carriage, acting on the levers of the brake-blocks, and projecting at each end of the carriage as far as the buffers, so as to come in contact with the ends of the brake-bars of the adjoining carriages.

On a check being given to the engine, and its speed being retarded, by applying the brake to the tender, the hindmost carriages of the train will press on those preceding them; and the springs of the ordinary buffers giving way, the train will be thereby shortened some inches; while the brake-bar of each carriage remaining of its original length, and resisting the advances of the carriages behind, it will follow that the last two or three carriages will have the brakes put on before even the guard in the van has turned the handle of his brake.

The two latter plans not having been yet tried, except in models, no practical results can be given; and they have been named with the view of bringing under the consideration of the members the important subject of the prevention of collisions of railway trains, by increasing the retarding power of the brakes.

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*The Use of Coal in Locomotive Engines.**

The following is a report by Messrs. Woods and Marshall, to the London and North Western Railway Company, on the burning of coal in locomotive engines:

Under the following resolution of the general locomotive committee of the 9th July, we have made a series of experiments on some of the engines of the southern division, with a view to report to you upon the questions submitted to us:

"Resolved,—That Messrs. Woods and Marshall be instructed to make trial of the various sorts of coal in the engines of the southern division, and to report to the next meeting of this committee whether coal can be efficiently and satisfactorily used, in what proportion, and at what cost, as compared with coke."

After conferring with Mr. M'Connell, and with a view to completing our report within the specified time, we judged it expedient to limit our

* From the London Mechanics' Magazine, September 30, 1854.

experiments to the trial of two kinds of coal, and to a comparison of the performances of an engine of the class known as Mr. M'Connell's patent, with those of an engine of the "Bloomer" class.

The Hawksbury coal seemed to be most eligible for use on the southern division, on account of its being procurable at a comparatively low price, in consequence of the proximity of the pits to the main line of the southern division.

The pits are situated on the Coventry and Nuneaton branch, about four miles from Coventry, and yield a coal of hard quality, free from any excess of bituminous matter; and, in other respects, (as, for instance, in freedom from clinker,) favorable for combustion in engine furnaces.

Two qualities of this coal have been submitted by us to trial, viz., Main coal, which is delivered in large blocks free from small coal, and the coal termed "screenings," or "cobbles," which is delivered in small lumps, but free from dust or slack. The prices, as given to us by Mr. M'Connell, are—

Main coal, delivered in contractor's wagons at Rugby, 9*s.* 7½*d.* per ton.
Cobbles, " " " 7*s.* 8½*d.* "

The cobbles are not so hard as the Main coal, and break into smaller fragments when struck by the hammer.

The cobbles can only be supplied in limited quantity.

For the purpose of comparison of the cost of working, it was important to obtain the exact duty of the engine with coke as well as with coal, and our series, therefore, includes the results of several days' work with the best coke we could obtain,—viz., Pease's West coke.

The engine worked alternate days with coke and coal, performing each day 164¼ miles, the double journey between Rugby and London.

The performances of the first two days are not here recorded, and may be considered as preliminary. The weather on one of these days was very stormy, and rendered the results of an exceptionable character; and the men had not then acquired the knowledge of the management of a coal fire, which a little further experience gave them.

For six consecutive days (the Sunday excepted) the passenger engine No. 303, Mr. M'Connell's patent, worked the 12·55 P. M. up express train, and the 5·45 P.M. down train, three days with Pease's West coke, and three with the Hawksbury Main coal; these two trains being nearly equal in weight, and presenting little variation during the period.

The details of these, and the subsequent experiments, will be found in the table appended, but the following are the general results:

No. 303 *Engine.*

Series.	Description of Fuel.	Miles run.	Average Load Carriages.	Average Speed per Hour.	Fuel Consumed per mile.	Water Evaporated per lb. fuel.
				Miles.	lbs.	lbs.
A	Coke	492¾	14·1	31·62	25·34	8·59
B	Coal	492¾	13·2	33·26	35·59	5·78

Deeming it necessary to ascertain the practicability of using coal with heavier trains, we caused the same engine, No. 303, to work the 6·30

A. M. down train and the 11·46 A. M. up train over the same ground. We had one day's experiment with coke, one day with Hawksbury Main coal, and one day with cobbles. The following are the results:—

No. 303 Engine.

Series.	Description of Fuel.	Miles run.	Average Load Carriages.	Average Speed per Hour.	Fuel Consumed per mile.	Water Evaporated per lb. fuel.
				Miles.	lbs.	lbs.
C	Coke	164¼	19·2	29·41	26·80	8·82
D	Main coal	164¼	20·6	28·96	41·66	5·86
E	Cobbles	164¼	29·3	27·76	51·49	5·97

The remaining experiment we have to record is with one of the largest class of the ordinary engines, No. 293, working the 12·55 P.M. up, and 5·45 P.M. down trains, with Hawksbury Main coal. The engine has a large fire-box, with a longitudinal mid-feather and two fire-doors.

No. 293 Engine.

Series.	Description of Fuel.	Miles run.	Average Load Carriages.	Average Speed per Hour.	Fuel Consumed per mile.	Water Evaporated per lb. fuel.
				Miles.	lbs.	lbs.
F	Main coal	164¼	14·1	32·96	47·75	4·52

The question of the practicability of burning coal in such locomotives must be answered in the affirmative. The engines had no difficulty in maintaining the required pressure of steam and speed with the trains assigned to them.

II. Taking a general view of all the performances of the engine No. 303 with coal, the consumption, or rather non-production of smoke, was very completely attained.

In the majority of cases, both in traveling and standing, the engine was practically free from smoke, the trace being so slight as to be imperceptible without close examination, and we did not observe in any instance that the smoke emitted could be accounted a nuisance.

From these remarks, we of course exclude the period of lighting the fire and getting up the steam, when the combustion is incomplete, and the production of smoke cannot be avoided.

The non-production of smoke, whilst the engine is working, no doubt depends very much upon the individual skill and care of the engineman and fireman, and demands very close and watchful attention on their parts.

The conditions under which the results related were obtained are as follows:

1. Working with a very thin fire on a large area of grate, and with fire-bars laid much closer together than is necessary for coke. By the large area of grate and thin fire, a large volume of air is enabled to pass through the ignited fuel under a moderate draft.

2. Frequent firing in small quantities to equalize the disengagement of the gases, and thereby prevent the production of a larger quantity at one time than can be saturated by the air passing through a grate or fire-door. This frequency of firing involves much greater care and labor on the part of the fireman. It was found in the trials, that, on an average, the fireman fired four or five times more frequently with a coal, than with a coke fire. Say once in every two or three miles, instead of once in ten or twelve miles.

In throwing on the fuel, the fireman has carefully to observe the state of the fire, that he may throw the fresh coal so as to maintain an uniform covering of the grate; the thickness of fuel ranged from about four to six inches.

3. *Alternate firing.*—The fire-box, divided longitudinally by midfeather into two separate compartments, each provided with a fire-door, gives the means of firing alternately, and thus keeping a bright fire in one box, whilst the other is damped by the addition of black coal.

4. The combustion chamber allows of the mixture of the gaseous products of the two fires with the quantity of free oxygen needful to effect their due saturation, affording space for combustion to take place before the gases pass into the tubes. This arrangement, combined with the double box, renders Mr. M'Connell's engine a more perfect "smoke-consumer" than the common engine.

5. *Quality of the Coal.*—The coals were in lumps of moderate size, to prevent obstruction to the draft, and sudden generation of a large volume of gas, which ensues upon throwing small coal or dust into a bright fire. Hardness in the coal is a quality which tends to diminish the proportion of dust from breakage. The coal should contain as little bituminous matter as may be, and burn with little ash or clinker.

6. Damper, to regulate admission of air to the grate, must be capable of being closed wholly or partially, otherwise smoke will be emitted, and fuel wasted at the stations.

It must be understood that the above were the conditions observed, and apparently required, in working the engine No. 303 efficiently and satisfactorily with coal; but we do not assert that these are invariable conditions as applicable to other engines, the different construction of which might adapt them to burn coal in another way.

The experiment with No. 293 engine did not give so good a result in point of smoke burning; a brownish tint of smoke was pretty constantly observable, but though sometimes very light, was frequently decidedly objectionable.

On the other hand, it is fair to state that the man who drove it had not had much experience in burning coal, which, as may be inferred from our foregoing remarks, requires a management of the fire altogether different from that of a coke fire.

We believe, however, that general experience shows that the ordinary engine is not well adapted for smoke burning, and it is certain, that in the case of No. 293 the smoke-box became overheated by a large accumulation of coal-dust partly ignited.

These effects were altogether absent in No. 303 engine, owing, doubtless, to the large receptacle in front of the tubes, which served to arrest

and detain in the fire-box the smaller particles of coal which otherwise would have passed through the tubes.

III. Relative powers of coke and coal.

The comparison of series A with series B indicates a consumption of coal 40 per cent. greater than that of coke in working similar trains, the average loads and speeds being nearly the same; but the work, as indicated by the consumption of water, being slightly less on the occasions when coal was used.

The comparison of series C and D, with a heavier and slower description of train, gives a consumption of coal 55 per cent. greater than with coke.

Taking the quantity of water as probably the most correct approximate measure of the several resistances, we find the mean duties to be as follows:—

1 lb. coke to 8·65 lbs. water;
1 lb. coal to 5·83 lbs. water;

which show a proportion of 100 lbs. coke as equivalent to 148 lbs. coal, as consumed in No. 303 engine.

We shall, therefore, assume 48 per cent. increase in estimating the relative cost of coal as compared with coke.

The more imperfect performance of No. 293 engine gives a much greater difference, being no less than 90 per cent.

The consumption of coke observed in these experiments accords very closely with the results of the experiments made under similar circumstances, and detailed in our former reports.

From the great excess in the quantity of coal consumed over coke, we are strongly disposed to think there must be something disadvantageous in the construction of the above engines, or in the mode of working them, as regards their applicability for the use of coal as fuel.

This view is confirmed by the results of some experiments made at Wolverton, in the fixed-engine boiler there, with the same qualities of coal and coke, wherein the difference of heating or evaporative power appears to be only 20 per cent., the evaporation being 7·99 lbs. of water per lb. of coke, and 6·77 lbs. of ditto per lb. of coal.

IV. Relative economy in cost of fuel.

The price of the Hawksbury Main coal being assumed at 9s. 7½d. per ton, and the price of Pease's West coke at 21s. 9d. per ton, which is the contract price for the same delivered at Rugby in the contractor's wagons, we may estimate that the cost of a quantity of coal equivalent to one ton of coke will be 14s. 3d., being 9s. 7½d. increased by 48 per cent.

Out of the 21s. 9d. paid for the above coke, we are informed that your Company receive back from the Midland Railway Company, under a special agreement, an allowance of 9d. per ton. This reduces the cost to Company to 21s. per ton.

The saving by use of coal would then be 6s. 9d. per ton., or the difference between 21s. and 14s. 3d.

Upon an annual total consumption of, say 74,000 tons on the southern division, the saving to locomotive power would be £24,975 from this cause.

This, however, assumes that all the engines are of a kind suitable for burning coal, and that no other fuel is used.

As far as our present experience goes, the large engines of the No. 303 class are the only engines on the line in which coal can be practically used without occasioning a nuisance, and these constitute at present but a small proportion of the entire stock.

The expediency of increasing the stock of such engines, for the purpose of effecting, wholly or partially, the saving in cost of fuel which we have indicated, is a question which your Directors will probably not consider within our province at present to discuss, involving as it does so many collateral considerations; also having reference to the general economy of the Company's expenditure—such as cost of engines and the general working expenses.

If the question be entertained as a general one for the whole line, the additional weight of fuel to be transported from place to place, (whether in the wagons or on the tenders,) and the additional number of hands necessary for emptying the wagons and distributing the coal, will occasion expenses which we have not taken into account.

Although we consider the experiments made with No. 303 engine satisfactory in point of smoke burning, we cannot resist the belief that the consumption of coal is in excess of what it ought to be, and that there is room for considerable improvement in this respect by means which shall tend to utilize the heat which is at present wasted.

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*Suggestion for Reducing the Shock in Railway Collisions.**

To the Editor of the Mechanics' Magazine:

Sir,—The greatest part of the mischief which is done in cases of collision on railways seems to be caused by the overturning and piling up of the carriages. If the blow which stops each carriage is not delivered exactly in the centre of gravity,—and it certainly will not be,—there will be a tendency to motion about that centre, either laterally or vertically, and the force being enormously great, either the carriages will turn over on their sides, or will break the coupling chains and be piled up endwise, just as would happen with the links of a chain in motion which should suddenly meet with an obstacle in front; but it will be seen that if the motion of the same chain were destroyed by stopping the last link instead of the first, there would be no such lateral or vertical forces. So also, if the opposing force could be made to strike the last carriage in a train instead of the first, and the coupling-chains were sufficiently strong, the passengers would be thrown forwards violently, but the carriages would remain on the rail, and no injury to the passengers more serious than a severe contusion would be possible.

This I think could be easily effected by having a bar of iron as long as the carriage hung under each of them, capable of sliding freely in the direction of motion. Have one corresponding thereto under the engine, and projecting in front of it as a common buffer, so that these rods may

* From the London Mechanics' Magazine, September 30, 1854.

form a continuous shaft, and communicate the force from one end to the other without affecting the carriages. When the train is made up, fix a cross-bar to the axis of the last carriage, and let the end of the proposed bar butt against it. In the event of a collision the coupling chains may break, but the greatest part of the momentum would have been destroyed before the ordinary blow is given. If there is no great objection to having this bar projecting for several feet beyond the front of the engine, each of the rods in question might be furnished with a common spring-buffer end, so that the force would be received by as many springs as there are carriages in the train, instead of by the single engine buffer, as is now the case. Perhaps, Sir, some of your practical correspondents may see a means of carrying this notion into effect, or will otherwise be good enough to point out the difficulty in doing so.

I remain, Sir, yours, &c., N. B.

AMERICAN PATENTS.

List of American Patents which issued from Sept. 5th, to Oct. 3d, 1854, (inclusive,) with Exemplifications by Charles M. Keller, *late Chief Examiner of Patents in the U. S. Patent Office.*

SEPTEMBER 5.

1. For an *Improved Mill Stone Dress for Cleaning Grain;* W. Ager, Rhorsburgh, Pa.

Claim.—"I claim the dress, consisting entirely of cracks, having inclinations for causing reverse drafts, so as to turn the grain and revolve it both on its longest and shortest axes, for cleaning and scouring said grain."

2. For an *Improvement in Flour Bolts;* Wm. H. Akins, Ithaca, New York.

Claim.—"I claim the connecting rod, in combination with the vibrating bracket and pulley over which a belt passes, said bracket being secured to an axle, for serving the double purpose of giving the bolt a short, quick, horizontal vibrating motion, and at the same time give it a rotary motion."

3. For an *Improvement in Spring Rollers for Window Curtains, &c.;* Benjamin Bray, Salem, Massachusetts.

Claim.—"I claim providing the tubular or hollow curtain roller with a long spiral spring within it, when said spring is used for the purpose not merely of drawing up the curtain by its recoil, as that is not new; but of balancing it in any position in which it may be placed."

4. For an *Improvement in Attaching Pulleys to Shafts;* C. Clareni, City of N. York.

"The nature of my improvement consists in casting a recess in the pulley, one portion of such recess being deeper than the other, and in placing therein a small roller, in such a manner that when the pulley is placed upon the shaft, it will bind and become a tight pulley when the shaft revolves in one direction, and loosen when the shaft is turned the reverse."

Claim.—"I claim the method of fastening pulleys to shafts, by having a cam cavity or recess in the pulley, and introducing therein a roller, as set forth."

5. For an *Improvement in Chimney Caps;* John Clark, Washington, D. C.

Claim.—"I claim constructing chimney caps having balance compensating valves, with lever and weight, or its equivalent, together with the valve opening at the top, whereby is prevented the undue accumulation of smoke within the space, thus affording the speedy escape of the smoke in its ascent upward through the chimney."

6. For an *Improvement in Seed Planters;* Charles H. Dana, West Lebanon, N. H.

Claim.—"I claim the staff and the reciprocating seeding box and apparatus, arranged in such a manner that the reciprocating movement of the seeding box and apparatus be upon one side or face only of its staff, will cause the seeds to be deposited by means of the measuring cavity in the staff, in connexion with the depositing cavity and the brush or elastic partition of the seeding apparatus, or their equivalents, combined and operating with each other. Also, the triangular measuring cavity in the staff, in connexion with the brush or elastic partition, and the depositing cavity of the seeding apparatus, arranged and operating to deposit the seeds, by means of the reciprocating movement of the seeding box, and being upon one side or face only of its said staff."

7. For an *Improvement in Seed Planters;* Louis Daser, Washington, D. C.

Claim.—"I claim the seeder, cut, and slot, in combination with the drill, the flared hole, spring, and cylinder."

8. For an *Improvement in Making Ribbon of Strips of Cloth;* Augustus M. Eastman, City of New York.

"The nature of my invention is to form upon the edge of narrow strips of velvet which are torn from broad pieces of 'broad yards,' made of any material from which velvet is woven, an artificial selvedge, which will exactly imitate a woven selvedge, and possess all the qualities of the woven selvedge."

Claim.—"I claim forming upon the edges of strips of velvet a firm artificial selvedge, by means of a brush or cushion, charged with a suitable adhesive compound."

9. For an *Improved Arrangement of Reefing and Furling Sails from the Deck of the Vessel;* William H. Foster, Portsmouth, New Hampshire.

"The nature of my invention consists in bending the sail to jack stays made fast on batten which I attach to and along the fore side of the yard, or on the back side thereof, if preferred, and in providing one or more reef bands, bolt or other ropes, or both, if necessary, to extend horizontally on the back of the sail at such distances below the yard as may be needed for each reef."

Claim.—"I claim the arrangement of the jack stay and batten with the main and minor reefing lines, furling or spilling lines, the line for manœuvring the dogs' ears, with the necessary sheaves and blocks, whereby the square sails of a vessel may be reefed and furled by the lowering of the yard, from the deck of the vessel."

10. For an *Improvement in Machinery for Worming Rigging;* Jonathan C. Ginn, South Thomaston, Maine.

Claim.—"I claim the combination and arrangement of the helical traveler, the box or tubular frame, and the bobbins or reels, composing a hand machine."

11. For an *Improved Portable Door Fastener;* Geo. W. Griswold, Carbondale, Pa.

Claim.—"I claim a portable or removable door fastener made in one piece, and having two or more arms at right angles to each other, with one serrated and one smooth edge, so that when either of said arms are introduced into the crack between the door and its frame, and turned one-quarter round, its teeth will be pressed into the frame, and the smooth edge of one of the other arms will be brought against the door, to prevent it from being opened."

12. For an *Improvement in Machines for Breaking Flax and Hemp;* John Hinde, Schenectady, New York.

"This invention consists in passing the flax, hemp, or other material, between a ribbed or fluted sheet or endless apron, and a series of fluted rollers which have a rolling and vibrating motion over its surface. The action of this sheet or apron and the rollers, is intended to resemble the action of the human fingers in rubbing and divesting the material of its boon or woody substance. I do not limit my invention to the employment of the apron and rollers, in connexion with the pairs of fluted and screw rollers, but intend to use them either alone or connected with any other apparatus for performing a preparatory breaking operation."

Claim.—"I claim the employment of a moving ribbed sheet or endless apron with a series of rollers working upon it. Also, giving to the said rollers a reciprocating motion backwards and forwards upon the sheet or apron."

13. For an *Improved Method of Hanging Plane Stocks;* M. G. Hubbard, City of N. Y.

"My improvement consists of the double set of planes having a movable bed between them supported against rollers for carrying forward the stuff to be planed without returning it back to its original place of entrance, or two boards planed at the same time, by which much time, friction, and power are saved for a given amount of work done."

Claim.—"I claim the mode of suspending the plane stocks below the edge of the plane, by which I increase the pressure on the heel of the stock as the resistance increases, and decrease the size of the springs and the amount of friction attendant thereon. Also, the gauge for preventing the insertion of a board of improper thickness."

14. For an *Improved Riving Machine;* Adoniram Kendall, Cleveland, Ohio.

Claim.—"I claim, 1st, The sliding knife, brace, springs, driving arms, the upper arm being separated from the lower, and the planes for raising the upper arm from the knife while the lower arm passes under. The several parts named, I claim, in combination, for the purpose of cutting a block from a bolt, and conveying it to the knife to be divided into two blocks ready to be carried forward by the drivers, to be again divided by the knives. 2d, The combination of the upper springs, the lower springs, knives, and the reciprocating drivers, for the purpose of conveying the blocks divided by the knife, from it to the knives, by which they are again divided. 3d, The two side pieces provided with grooves or channels, with the tumbler, the middle channels being of such inclination that the drivers ascend in passing from the knife, and return by means of the tumbler in the channel. The driver descends in passing from the knife, and returns in the channel, and is thrown up in place by the springs. I claim, also, the combination of the grate plates with the tumblers and springs, or other equivalent devices, for the purpose of giving the proper direction to the reciprocating drivers."

15. For *Improved Driving Wheels of Locomotives for Ascending Inclined Planes;* J. Morss, Washington, District of Columbia.

"The nature of my invention consists in the use or employment of elliptic driving wheels on locomotive engines, in connexion with curved rails, by means of which a locomotive of sufficient power is enabled to draw a much greater load up a much steeper grade than it can overcome upon the usual plan, without reference to its weight or vertical pressure upon the track."

Claim.—"I claim the use or employment of inclined driving wheels upon locomotive engines, or their equivalents, in combination with the curved rails."

16. For an *Improvement in Ice Cream Freezers;* Thomas M. Powell, Baltimore, Md.

Claim.—"I claim the manner of constructing ice cream freezers with three or more cylinders, arranged for the purpose of more speedily and effectually freezing the cream."

17. For an *Improvement in Tables;* Charles Rowland, Belleville, Illinois.

Claim.—"I claim constructing the supports of the table so as to form seats capable of being closed and withdrawn."

18. For an *Improved Machine for Feeding Paper to Printing Presses;* Bradford A. Rugg and Ezra H. Benjamin, Oak Hill, New York.

"The nature of our invention consists in providing a series of rollers and endless aprons, so arranged that by placing the paper between the aprons the sheets shall be separated and delivered, one by one, into the printing press with as much rapidity as desired."

Claim.—"We claim the combination of one or more endless aprons in such a manner that the sheets of paper in approaching the printing cylinders, shall be rolled around a roller, and thus caused to overlap each other. 2d, We claim the combination of the dropping board with the apron, in the manner set forth."

19. For an *Improvement in Machinery for Dressing Flax;* Daniel Warner, Jr., South Hadley, Massachusetts.

Claim.—"I claim the construction and arrangement of the heckling and scutching drums; that is to say, drums having a series of heckling bars, or bars armed with teeth, set at an angle with the radius, in combination with the blunt-edged or scutching bars, and the drums so made arranged in two rows, one above the other, with the centres of their shafts diagonally placed, so as to cause the flax, in passing between, to be acted upon by both sets of drums."

20. For an *Improvement in Stringed Musical Instruments;* G. L. Wild, Baltimore, Md.

Claim.—"What I claim does not consist simply in the employment of screws, or their equivalents, for tuning and keeping stringed musical instruments in tune; neither do I claim any particular shape, arrangement, or form; but I claim, 1st, The employment of the supporting projection, or its equivalents, of the tuning screw, for the purpose set forth. 2d, The use of the slot and guides, or their equivalents, for the purpose described. 3d, The bridle, or its equivalents, operated by the harmonizing screw, or its equivalents, for the purpose specified."

21. For an *Improvement in Doors for Baggage Cars;* Henry L. Clark, La Port, Ind.

Claim.—"I claim having the door placed between ways which are secured to the side of the car by hinges, and forcing the door outward by the device shown, or its equivalent, so as to cause the outer ends of the hinged ways to be in contact with stationary ways, between which said door is shoved when opened."

22. For an *Improvement in Railway Lamps;* Leroy S. White, Chicopee, Mass., Assignor to self, Lewis White, Hartford, Conn., Lyman White, Springfield, Mass., and Augustus G. Stevens, Manchester, New Hampshire.

Claim.—"I do not claim the employment of a tube or passage descending through the burner so as to admit air to the interior of the wick tube and flame; but what I do claim is, the arrangement of the filling orifice and the air tube leading out of the closed secondary oil and carbon receiver or chamber under the wick tube, such arrangement consisting in placing the filling orifice on the upper part, and at or near one end of the lamp, and carrying the oil tube in an inclined direction through the main oil chamber, and out of the top thereof, whereby the contents of the secondary oil receiver may be emptied from the said receiver and through the tube, without danger of spilling the contents of the main oil receiver out of the filling orifice thereof."

23. For an *Improvement in Brick Presses;* A. H. Brown, Georgetown, D. C.

Claim.—"I claim, 1st, The peculiar construction, each separate frame or link in the chain of moulds forming a part of two moulds, the projecting plate, as the moulds pass over the first octagon, closing so as to form the bottom of the preceding frame and the side, closing against the ends of the preceding frame so as to form a perfect mould when the chain is horizontal; as the frames pass over the second octagon, the sides and the ends releasing themselves from the plate of the preceding frame, leaving the brick free upon the plate, so that it may be easily discharged, the lugs gearing into the octagons for propelling the moulds. 2d, I claim, for the purpose of compressing dry clay into bricks, the combination of the two plungers with the cams, the cams revolving and the plungers moving in unison, the first cam having the longest radius, and causing the first plunger to descend the greatest distance upon the easily compressible clay, the second cam which actuates the plunger having a smaller radius than the first cam, so that the greatest force of compression is applied to the clay already partially compressed where the greatest power is required."

SEPTEMBER 12.

24. For an *Improvement in Machines for Cleaning Wool;* Leander W. Boynton, South Coventry, Connecticut.

Claim.—"I claim the combination of the cylinder with the hollow or mandrel, when these are combined with the horizontal vat, divided into two or more apartments."

25. For *Apparatus for Turning the Leaves of Books;* Hezekiah C. Bridgham, New London, and James M. Stewart, Norwich, Connecticut.

Claim.—"We claim, 1st, The combination and arrangement of the lever, pawl, ratchet wheel, and pin roller, or their equivalents, so constructed and operated as to raise the pawls in succession, and allow the fingers to turn the leaves of a book, as required. 2d, The combination and arrangement which operates the fingers separately, when the leaves of a book are turned back to repeat a portion of the tune, in combination with the apparatus which operates the fingers successively, the apparatus which operates the fingers separately, when used in repeating, being so constructed and arranged as not to derange the apparatus which operates the fingers successively. 3d, Making one fork of the fingers elastic, or operating it with a spring so as to gripe the leaf of a book when placed between said forks."

26. For *Improvements in Surface Condensers for Marine Engines;* Daniel Carpenter, Brooklyn, New York.

Claim.—"I do not claim, broadly, the use of a perforated plate in combination with the tubes of a surface condenser; nor do I claim, broadly, the use of clamp plates for clamping tubes; but I am not aware that several series of tubes have been bound together by outside clamps and interposed groove bars, to bind all the tubes together in all directions. What I claim in a surface condenser, in which the steam to be condensed is made to pass outside of the tubes, is, putting the tubes close together by making the two ends of the tubes which pass through holes in the tube sheet of a smaller diameter than the body of the tubes, and securing them in place by means of nuts tapped on to the ends thus reduced. Also, in combination with a congeries or set of tubes, arranged to constitute a surface condenser, which effects the condensation of the steam outside of the said tubes, a guard plate or plates with apertures between the exhaust port or inlet for the steam, and the side or sides of the set of tubes, for the purpose of protecting the tubes from the violent concussions of the steam when entering. And I also claim, as a means of resisting shocks and preventing the vibration of the tubes of a condenser, the employment, in combination, of the outside clamp bars and interposed bars grooved to embrace the tubes, so that when bound together they shall be firmly held to resist all lateral motion or vibration, whilst at the same time the clamps and interposed bars will further act as diaphragms to direct the steam across the set of tubes."

27. For an *Improvement in Boots and Shoes;* Nathaniel Colver, Detroit, Michigan.

Claim.—"I claim the construction of boots and shoes, (with uppers as now constructed in the United States,) with a wooden instead of a leather sole or bottom attached to the leather uppers, as described."

28. For an *Improvement in Metallic Slat Shutters;* John B. Cornell, City of N. Y.

Claim.—"I claim the manner of uniting the sheet metal slats of the shutter by swaging the edges of the slats into forms of corresponding segments of circles, and connecting them by means of hinged bars combined with said slats, and arranged in such a manner that the pivots of said hinges will be concentric with the segmental curves of the edges of the slats, and also cause the flat portions of said slats, when the shuttle is open, to be directly in line with each other."

29. For an *Improvement in Oscillating Engines;* Wm. Craig, City of New York.

Claim.—"I claim the steam pipe or valve, operated by means of the eccentric rod for obtaining a double action, in combination with the follower and trunnion of an oscillating steam engine, for the purpose of admitting steam into the face of the trunnion without regard to size of parts. Also, the mode of arranging the eduction and induction ports without regard to size."

30. For an *Improvement in Mill Stone Dress;* P. Dickson, Woodcock Township, Pa.

Claim.—"I claim the dividing the face of the runner and bed stone, into three circular courses of furrows, all the furrows in A B having the same draft, and having twice the number of furrows in B C than there is in A B, and giving these furrows the same draft in respect to themselves, but a different draft from the furrows in A B, in combination with the furrows in the third course, C D, to operate as conveyors, in the manner described."

31. For an *Improved Piston or Valve for Rotary Pumps, &c.;* J. Gatley, Rome, N. Y.

Claim.—"I claim the use of a frame filled with friction rollers to move with the sliding piston, embracing, also, the method of interlocking, as described, or substantially the same. Also, the modification to adapt my arrangement, meanwhile maintaining the requisite efficiency to any purpose where motion is to be communicated through the revolution of the arms, wings, or vanes, the two opposite extremities varied in their relative length by means of an eccentric cylinder or ring."

32. For an *Improvement in Straw Cutters;* Warren Gale, Troy, New York.

Claim.—"I claim the arranging the flanch or flanches on one cylinder, so that they will meet the knife or knives on the other cylinder, as the two cylinders rotate. Also, in combination with the flanched cylinders, the throat placed in such relative position to said flanched cylinders as to nearly meet the latter at a desired point in their revolution, thus assisting to give a long cut, if said throat be expanded, and a short cut when the throat is contracted."

33. For an *Improvement in Coupling for Carriages;* Abram J. Gibson, Clinton, Mass.

Claim.—"I claim the employment of a cylindrical bar of iron, having a threaded bolt projecting downwards, and working in a threaded cylinder on the forward axle. Also, in combination with the cylindrical bar of iron, the manner of connecting the rear with the forward axle, by means of a thread bolt formed at the connexion of the rods or perches, and working in a threaded chamber cut in the cylindrical bar."

34. For an *Improvement in Ventilating Ship Timbers;* Joseph L. Harley and Samuel Maxwell, Baltimore, Maryland.

Claim.—"We claim a ventilator, consisting of the tube, cap fitting thereon, sustained by means of the double acting spring on the stem, by which the cap is kept open, or securely closed when down."

35. For an *Improvement in Trusses;* Seymour N. Marsh, City of New York.

Claim.—"I claim, 1st, The ring pad to close the external and internal abdominal rings, by making pressure specially upon those parts, and not over the entire external surface of the canal. 2d, The interior ball pad, combined with the ring pad, for the purpose of producing upon the inguinal canal, a pressure for the purpose of creating adhesive inflammation, which pressure is entirely independent of the pressure upon the ring pad, and the consequent resistance of the abdomen of the patient, and which is capable of being regulated by a screw, or other equivalent means provided for the purpose."

36. For an *Improved Method of Applying Heat to Dilate Gases, for the purpose of Elevating Water;* John W. Middleton, Philadelphia, Pennsylvania.

Claim.—"I make no claims to elevating fluids by the dilation or contraction of gaseous media, whether by natural or artificial heat; but what I do claim is, the method herein described and represented, of applying heat to elevate water."

37. For an *Improvement in Corn Shellers;* G. Maynard, Greenfield, Massachusetts.

Claim.—"I claim the arrangement whereby two shelling wheels, with their axis parallel, turning in opposite directions, are made to operate simultaneously upon one ear of corn, the ear being fed in between the said wheels."

38. For an *Improvement in Cooking Stoves and Ranges;* J. MacGregor, Jr., City of N. Y.

Claim.—"I claim having a flue or flues surrounding the oven or ovens."

39. For an *Improved Regulator for Gas Burners;* Andrew Mayer, Philadelphia, Pa.

Claim.—"I do not claim the employment of a conical valve to regulate the flow of gas, irrespective of the peculiar construction of the said valve; but I do claim the employment of a hollow conical valve perforated at its apex, and having openings around its base, and being arranged with a box which receives the gas through an opening under the valve."

40. For an *Improved Apparatus for Distributing Fluids;* John W. Middleton, Philadelphia, Pennsylvania.

Claim.—"I claim the arrangement of a water reservoir and air vessel between the service pipe and the distributing cocks, or near the latter. Also, the vertical pipe, water and pressure gauge, to regulate the flow of fluid through pipes."

41. For an *Improvement in Apparatus for Determining the Weight of Cargoes in Vessels;* Ephraim Morris, South Bergen, New Jersey.

Claim.—"I claim, 1st, Determining the level of the water, and the consequent weight of the cargo, by means of a plunger, hollow rod, glass tube and bulb, applied to the tube containing the water. 2d, The adjustable socket with an index marked thereon, in combination with a hollow rod and plunger, whereby the apparatus is adapted to different boats of the same size, or to the same boat under various circumstances."

42. For an *Improved Spoke Machine;* Newell North, Stow Township, Ohio.

Claim.—"I claim, 1st, The index and cam crank, in combination with the forked centre or holder, and the carriage, or their equivalents. 2d, The combination of the handle and rod, and lever and poppet centre, and adjustable cross bar and screws, the same being combined with the carriage frame and guides. 3d, The arrangement or relative position of the cutters with respect to the set of cutters. 4th, The support or standard and springs, or their equivalents, combined as described. 5th, The combina-

tion of the set of cutters, or any equivalent combination, for the purpose of planing two sides and one edge of the spoke, with the one and the same set of cutters."

43. For an *Improvement in Breech Loading Cannon;* Wm. E. Osborn, Milton, N. Y.

Claim.—"I claim, 1st, The eccentric or cam shaped piece set on trunnions, so that the operation of rotating said breech piece on its trunnions, by a lever or any suitable means, compresses the curved surface of said breech piece against the rear of the bore or calibre of the gun. 2d, Removing said breech piece from the line of the bore or calibre of said gun by rotating said breech in the reverse direction, causing the cam or projection, or its equivalent, to act as a fulcrum, on which said breech is lifted by the one operation of rotating the breech, the trunnions sliding up in the grooves. 3d, The construction and arrangement of the hammer and nipple, whereby the hammer is cocked by its own weight, for the purpose specified."

44. For an *Improvement in Tailor's Sheers;* Joseph Phares, Cincinnati, Ohio.

Claim.—"I claim, 1st, The placing of the rivet of tailor's shears outside of the angle formed by prolonging the directions of the cutting edges, for the purpose of giving to the cutting point of the edge an oblique backward motion, thereby increasing the ease of cutting, diminishing the resistance to working the shears and bringing the cutting points nearer the hand. 2d, Combining with this the guide, a stud set in one blade working in a curved slot in the other, having a screw thread cut on it, on which is placed a rivet head nut, or other equivalent device, for the purpose of steadying the motion of the edges, and more effectually securing them from spreading in working."

45. For an *Improvement in Sewing Machines;* Philander Shaw, Abington, Mass.

Claim.—"I claim the combination, applied to the shaft for imparting to it an intermittent rotary motion, so as to obtain the length of stitch, as specified, such combination consisting of the cam, the wheel, the movable or sliding box, or its mechanical equivalent, and the spring applied together and to the shafts, and made to operate."

46. For an *Improvement in Portable Grist Mills;* Samuel Sheldon, Cincinnati, Ohio.

Claim.—"I claim securing the stationary stone to an upright flanched plate, and the adjustment of said plate by means of slotted flanches and bolts, for insuring in a simple and effectual manner, the parallelism of the faces of the stones, when the same is applied to a mill in which the axis of revolution of the running stone is horizontal."

47. For an *Improvement in Palate for Artificial Teeth;* L. Simonds, Boston, Mass.

Claim.—"I claim attaching to an artificial palate, or to any plate to be secured in the mouth, an air chamber, constructed with a flexible elastic diaphragm, for more effectually exhausting the air between the artificial palate and the roof of the mouth."

48. For an *Improvement in Curtain Fixtures;* D. Carlos, Smart, Cambridgeport, Mass.

Claim.—"I claim the combining the centre pin of the curtain roller with the roller, by means of a screw, and making the pin with a head, by which it may be revolved, the same enabling me not only to dispense with the usual counter-balancing weight necessary for the window shade or curtain, but to form in the window frame the female centres or bearing holes by the pressure of the screw, and thereby I dispense with the usual socket pieces generally applied to the window frame for supporting the roller."

49. For a *Mode of Operating Fire Engines;* F. G. Smith, Columbia, Tennessee.

Claim.—"I claim constructing fire engines with springs, in any manner substantially the same as hereinbefore set forth, and for the purpose specified."

SEPTEMBER 19.

50. For an *Improvement in Breech Loading Fire Arms;* H. W. Adams, City of N. Y.

Claim.—"1st, Though I do not claim the breech roller having a passage through it so that when placed in one position in the chamber which receives it, it will form a prolongation of the bore, and when placed in another position will close the rear end of the bore; I claim the combination with the said roller, of the common gun nipple, said nipple being inserted at one end of the said roller which projects outwardly from the said chamber, and communicating with a vent bored to the surface of the central solid part of the said roller, which covers the end of the barrel, so as to convey fire from the nipple to the centre of the charge in front of the roller. 2d, Though I do not claim the employment of a groove or grooves, as made in the charge holder of Alonzo D. Perry, I do

claim forming a cavity or space within the chamber which contains the breech roller, when the said cavity extends all round the said roller, and so nearly from end to end thereof as to leave only sufficient bearing at the ends to keep the said roller in proper place, and is for the purpose of reducing the friction of the roller, and for the prevention of its sticking tight in the chamber. 3d, Fitting the opening in the rear part of the breech supporter with a tube, which enters the space between the breech roller and its seat and fits closely up to the roller, serving the double purpose of giving the roller a bearing opposite to where the force of the explosion of the charge acts upon it, and of preventing the escape of the fire or gas through the back of the breech supporter. 4th, The chamber detached from the barrel and fitting into the breech supporter, so as to be incapable of turning therein, but to be capable of being forced up towards or into closer contact with the breech roller, by the screwing in of the barrel."

51. For an *Improvement in Machines for Dressing Mill Stones;* Elliot C. Badger, Warner, New Hampshire.

"The nature of my invention may be thus described: 1st, I attach a bevel gear wheel to the mill spindle which turns a pinion and shaft, to which a cam is attached, and that operates and gives motion to the chisel, or other tool which is used for furrowing mill stones."

Claim.—"What I claim is, the guide, with the narrow slot in a straight line, or such curve as is desired to give the furrow in which a projection from the frame carrying the pick works, and by which the pick is guided, as it is drawn out to cut the furrow desired, and this either with or without the thread screw, by which said guide is moved radially around the cylinder and spindle."

52. For an *Improvement in Steam Engines;* W. Black, Allegheny, Pennsylvania.

Claim.—"I do not claim forcing unmixed water with a highly heated cylinder, as that mode is shown and described in Mech. Mag., vol. v., p. 1; nor do I claim re-heating and re-densifying steam that has been used in one cylinder to expand and use it in another cylinder of larger size, as this is set forth in a patent granted to James Frost, in 1841; nor do I claim having discovered a new principle in super heating steam apart from water, such as is set forth in an application for a patent by James Frost, in 1845; nor do I claim the discovery of a mode of creating power by super heating steam as it passes between two engines, one low and one high pressure; nor to have invented a mode of using the spent or free steam for cooling and warming water, as set forth in an application for a patent, by James Frost, in 1849; nor do I claim using the highly heated air as a motor, or for generating steam by passing highly heated air through water as it falls from one shelf to another; such was done by De Rosen, and is described in Newton's London Journal, vol. i, 2d Ed., page 156; but what I do claim is, the mixing, by means of a revolving brush, or some other mechanical equivalent, small drops or particles of water in the steam. Also, the immersing the ramming chambers or pumps in water, or its equivalent, for the purpose of chilling the saturated steam suddenly, and just before it is forced into the heated cylinder. Also, the ramming or forcing the highly saturated steam into the heated cylinders in the manner set forth."

53. For an *Improvement in Maize Harvesters;* James S. Burnham, West Jefferson, O.

Claim.—"I claim the employment and arrangement of the oblique self-adjusting, cutting, and sustaining platform, having a flanch on its back edge, and cutters arranged or formed on its front edge near either end. Also, the employment of the horizontal collecting reels, having their arms made elastic and of cima reversa shape, in combination with the guards, oblique fenders, guides, and receivers or bundlers. The arrangement of the receiver arms or bundlers, moved by the shifting lever and connecting rod, for the purpose of readily effecting the discharge of the stalks."

54. For a *Method of Sawing Shingles;* C. J. Conrad, Lower Augusta Township, Pa.

Claim.—"I claim the use or employment of the notched register plates, one being constructed with equi-distant notches, the other with notches placed alternately at about three-fourths and one-fourth of the distances of the first mentioned, in combination with the register frame, its counterpoise weight, and the levers."

55. For an *Improvement in Telegraphic Keys;* John Davis, New Bedford, Mass.

Claim.—"I do not confine my invention solely to the producing of the dots and marks which Morse uses in operating his telegraphic register; any arrangement may be produced; neither do I confine my invention to the operating of Morse's telegraphic regis-

ter; it may be applied to any telegraphic registering apparatus where spaces, dots, long and short marks are used for transmitting and recording information by telegraph; neither do I confine my invention to the working of the respective slide with its pinion and rack; it may be operated by passing the slide against the shaft or roll friction, producing the same as the rack; neither do I confine my invention to the spiral spring; any other may be used. What I do claim is, the construction of a bank of telegraphic keys, operated by their respective pinions, or by a roll with or without teeth, said pinions or roll may be operated by clock work, or by any known motor, and thereby operating the well known magnetic lever, causing the connexions of the battery circuit to be completed and broken a succession of times by a single operation of the operator, said connexions to be of a longer or shorter duration, as the respective symbol on the respective slide shall indicate."

56. For an *Improvement in Bee Hives;* Henry Eddy, M. D., North Bridgewater, Mass.

Claim.—"I claim nothing original in dividing the hive into upper and lower apartments, nor the insertion of panes of glass in the sides of such apartments; but what I claim is, the arrangement of metallic protectors in a movable slide or bottom."

57. For an *Improvement in Making Slag Ware;* William Gilbert Elliott, Blisworth, England; patented in England, Oct. 5, 1852.

Claim.—"I claim the improvement in the manufacture of bricks, pipes, tiles, and other articles capable of being moulded from slag, (or from a liquid mass analogous to slag,) in a melted or fused state, such improvement consisting in expelling the gases of the slag by piercing and pressure at the same time, when the slag is in a mould."

58. For a *Sewing Machine;* Benjamin Fulghum, Richmond, Indiana.

Claim.—"I claim sawing timber by placing a saw within a carriage attached to frames jointed or connected together, and operating in the manner described."

59. For an *Improved Portable Staging;* William P. Goolman and Samuel Morris, Springtown, Indiana.

Claim.—"We claim, 1st, Conducting the rope which supports the platform, G, to the platform, G′, fastening it thereto, so that the workmen on the platform, G′, can traverse both platforms simultaneously, in either direction. 2d, Connecting the bars of the connecting bridge with hinges, so that they may be folded to use part of its length, or so as to occupy a shorter space in transporting from place to place. 3d, The additional links so constructed, arranged, and connected with the other links as to sustain and support the bars or rails of the bridge, when the bars are swung round to shorten said bridge."

60. For an *Improvement in Vault Lights;* Thaddeus Hyatt, City of New York.

Claim.—"I claim the making a vault cover by the union of two metal pieces, of which one is formed as a grating, and the other is formed with an opening whose area is at least equal to the combined area of all the openings in the grating, (the area of the one being covered over by the grate bars of the other,) in combination with a glass or layers of glass, protected by the grating and covering the opening of the metal frame in which they are set."

61. For an *Improvement in Air Engines;* James R. Napier, Glasgow, and William J. Macquorn, United Kingdom of Great Britain and Ireland; patented in England, June 9th, 1853.

Claim.—"We make no claim to any of the mechanical parts separately; but we claim, 1st, The adaptation of a heat screen, the form of which may be varied, and the means of giving motion thereto may also be varied; the said heat screen being separate and distinct from the plunger which drives the air or other gas from the hot to the cold end of the receiver, and vice versa, and being adapted to the following purposes: 1st, To screen the principal portions of the air or other gas from the communication of heat from the furnace or source of heat at those times when that heat would impede the motion of the engine, that is to say, when the air or other gas is being passed towards the cold end of the receiver to be cooled, when it is not being expanded, and when it is being compressed. 2d, To receive and store up in its own material at such times, the heat communicated from the furnace. 3d, To permit and accelerate the communication of heat to the air or other gas, at the time when it is most effective in developing mechanical power, that is to say, when the air or other gas is being expanded. We claim the adaptation of tubular receivers, for the purpose of heating and cooling the air or

other gas, by the aid of rod-shaped heat screens or plungers, nearly filling the tubes, and serving, by being moved out and in, whether by the mechanism shown in the drawing, or by any other suitable mechanism, to admit and expel the air or other gas, and promote its circulation over the heated or cooled surface. We do not claim the invention of tubes as a means of increasing heat conducting surface; but simply the adaptation of tubes to engines worked by the action of heat on air or other gas, by the aid of the rod-shaped heat screens or plungers."

62. For *Tidal or Current Hydraulic Ram;* J. W. Middleton, Philadelphia, Penna.

Claim.—"I claim the combination of a weighted lever or float with a series of narrow strips, each hinged at or near its middle, so that the pressure of the water above and below the hinge may be nearly equal, these strips being arranged across the lower end of the tube to close and open it alternately. Also, the arrangement of the strips in a curve, and turning them in the act of opening different distances to keep them parallel to each other, thereby permitting the water to flow more freely."

63. For *Fire Arm;* Wm. H. Morrison, County of Marion, Indiana.

Claim.—"I claim, 1st, The arrangement of the turning lever, and the manner in which it is made to turn the revolving cylinder, and of the plate behind the cylinder on which the turning lever operates. 2d, The arrangement and combination of the levers, by which the catch, that arrests the revolution of the cylinder, is operated on, and the manner in which these levers are worked by the turning lever. 3d, The arrangements by which the revolving cylinder is thrown out to the side so as to clear the barrel in loading, without detaching the former from the gun. 4th, The use of the cutter at the bottom of the bore of the barrel for opening the cartridges. And I claim the use of such a cutter, whether of the particular shape herein described, or not."

64. For a *Mode of Constructing the Backs of Car Seats into Beds or Lounges;* Henry B. Myer, Buffalo, New York.

Claim.—"I claim the construction or formation of beds or lounges on the backs of railroad car seats, by turning them up to and retaining them in a horizontal position, and so arranging the backs of contiguous seats that they may meet and remain in the same horizontal plane by the methods herein described."

65. For *Breech Loading Fire Arms;* Abner N. Newton, Richmond, Indiana.

Claim.—"I claim, 1st, Constructing the breech with a hinged lip, which fits to a recess in the chamber, and receives the charge when the breech is drawn back, but forms part of the chamber when the breech is in place for firing, and which, when the breech is moving back and forth, is capable of a slight vibration to compensate for any want of truth in the breech or its fittings, and to enable itself to rise from the floor of the recess in the chamber to be supported by a friction roller in running back and forth, but to bed firmly on the floor of the recess, when the breech is in place for firing. 2d, The method of operating the clamps to lock and unlock the breech by means of the crossed or shears levers, the double slotted lever, and the plate or broad arm on the transverse shaft. 3d, Moving the breech back and forth by means of arms attached to the same shaft, which is the first mover of the mechanism which actuates the clamps to lock and unlock the breech, the said arms entering recesses in the sides of the breech. 4th, The attachment of the hammer, main spring, tumbler, and feather spring, or all that combination of parts constituting the lock of the gun to the movable breech, or to the same carriage therewith in any way, whereby the movement of the breech is made to effect the cocking and setting free of the hammer to explode the charge. 5th, So constructing the inclined way on the gun carriage which actuates the arm of the lock in cocking the hammer, that if the hammer escapes it will be prevented by the arm coming in contact with the said way from striking the needle, or its equivalent, which explodes the charge, until the breech pin has entered the chamber of the gun."

66. For an *Improvement in Rosin Oil Lamps;* Isaac Pitman, Reading, Mass.

Claim.—"I claim the regulation of the outer current of air of the burner, by means of a sliding ring, or by substantially like means, the same in combination with the vertically stationary and constantly and unvaryingly exposed wick setting snugly between two tubes of unequal height."

67. For an *Improved Water Metre;* Marvin Smith, New Haven, Connecticut.

Claim.—"I claim, 1st, Constructing the piston with cells, arranged in any way substantially as described, to communicate with the inlet and outlet pipes of the cylinder,

so that by a slight movement of the piston on its axis, the communications of the upper and lower parts of the cylinder with the inlet and outlet pipes may be reversed. 2d, The combination of the tongue on the piston rod, the vertical fixed guide, and the connected weighted levers, for the purpose of moving the piston on its axis at the end of every stroke, and thereby reversing the communications of the inlet and outlet."

68. For an *Improvement in Counting Machines, and Machines for Indicating Motion;* Wm. G. Sterling, Bridgeport, Connecticut.

Claim.—"I claim the combination of the revolving endless screw marked with figures on its surface with the stationary toothed nut with a female screw in its centre, fitting the screw on the revolving ring, for the purpose of causing the revolution of said ring."

69. For an *Improvement in Pumps;* John Tapley, Frankfort, Maine.

Claim.—"I claim the arrangement of two cylinders in a line with each other, connected by a frame and fitted with valves, stuffing boxes, and a tubular plunger, which works in both, and has a valve arranged in its middle, the plunger and each of the cylinders being made in two pieces, at the junction of which a valve is secured, so that, without separating the cylinders and plunger, or dismounting either of them, any one of the valves or the packing of the plungers can, with facility, be adjusted, removed, or replaced."

70. For an *Improved Safety Washer for Securing Wheels to Axles;* Wm. Thornley, Philadelphia, Pennsylvania.

Claim.—"I claim a washer having a projecting flanch, and stop or stops; also, the cap with the stop or stops."

71. For an *Improvement in Sausage Stuffers;* John J. Weeks, Buckram, N. York.

Claim.—"I claim the arrangement of the adjustable shaping and protecting tube, in combination with the filling tube."

72. For an *Improved Machine for Sawing Fire Wood, &c.;* Archibald Winter, Rondout, New York.

Claim.—"I claim the employment or use of the endless chains provided with hooks, and arranged with a circular saw, one or more, as shown."

73. For an *Improved Method of Operating Guide Rollers and Feed Clamps in Sawing Machines;* Loren J. Wicks, City of New York.

Claim.—"I claim connecting the two clamps of each pair together by means of the racks and pinions, one clamp of each pair being made adjustable, and connecting the guide rollers together by means of the segment racks and pinions, the rollers, racks, and pinions being secured or attached to a movable or jointed frame."

74. For an *Improved Apparatus for Polishing Daguerreotype Plates;* B. F. Upton, Bath, Maine.

Claim.—"I claim the combination and arrangement of mechanism for supporting the polishing board, maintaining it constantly in one plane, and imparting to it a reciprocating motion, the said combination consisting of the two rocker sectors, the two sets of forward and back draft belts, the connecting rod, and crank, applied as specified."

75. For an *Improvement in Grain and Grass Harvesters;* Abner Whiteley, Springfield, Ohio.

Claim.—"I claim the rack, having on one of its blades a swinging or suspended rake, whose ends pass between and are combined with ways or guides, for the purpose of not only delivering the grain at the rear of the platform, but also, better directing the standing crop to the cutter. I claim the latch with appendages, for the purpose of making the rake gather more or less grain. Also, placing the vibrating knife bar and cutters thereon, between alternately placed fingers, for the purpose of dispensing with the slot guards and sustaining the line of cut, by throwing the action of the alternated shear edge of the blade of said cutters on the upper and lower sides of the fingers."

76. For an *Improvement in Calendar Clocks;* Wm. H. Akins and Joseph C. Burritt, Assignors to W. H. Akins, Ithaca, New York.

Claim.—"We claim, 1st, The arrangement of the four rows of teeth on wheel L, in combination with the corrugated plate, the detent, and the cam, the rocking shaft, and the slotted arm, or the equivalent of said arms and rocking shaft, and for the purposes

set forth. 2d, Raising the clicks 37, over 4 or more of the teeth of the wheel (when run down,) on the first day of the month, thereby acquiring a retaining power sufficient to be used in the short months; thus, moving the wheel carrying the hand on the dial from the 28th day of February, past the 29th, 30th, and 31st divisions of the wheel, to the figure 1, or the first day of March, those teeth (the 29th, 30th, and 31st,) being removed, the detent stopping the wheel at the point marked 1, on figure 8, indicating the first day of every month, one tooth only being used, except at the last day of a short month, the rod, 30, slipping through the end of the lever. 3d, We also claim the combination of the helix, the lever, lifting rod, the detent, the pin, the click, the wheel, and spring, for the purposes described, that is, giving movement to the wheel, the rollers being moved by similar devices."

77. For an *Improved Gold Separator;* Edward L. Seymour, Assignor to Daniel B. Brown, City of New York.

Claim.—"I claim making the said receptacle or vessels of two, three, or more sections, arranged one above another perpendicularly, so that they may be slid off in succession, in a horizontal direction, or otherwise removed, to remove the refuse matter separated from the metal in the first or top section, and the several other layers of stratified matter contained in the other sections, according to their respective specific gravities."

78. For an *Improvement in Calendar Clocks;* John Williams, Assignor to F. Curtis & Co., Hartford, Connecticut.

Claim.—"I claim the wheel *l*, carried by the wheel *e*, and combined with the lever and its stop, and the pin upon the wheel *b*, to engage the lever, the said wheel *l*, having on its periphery forty-eight cogs or teeth, each cog or tooth representing a month, and having upon its upper face three pins and a fourth pin; the three pins making the month of February for three successive years, and the fourth pin the leap year; also, the pins to mark the months of thirty days."

SEPTEMBER 26.

79. For an *Improvement in Gas Generators;* N. Aubin, Albany, New York.

Claim.—"I claim the combination of the gas generating retort with the diaphragm steam generating retort, charged with porous earth, pieces of brick, pumice stone, or some other porous substance."

80. For an *Improvement in Fire Arms;* Fordyce Beals, New Haven, Connecticut.

Claim.—"I claim the rotating of chambered breech or cylinder, by means of a double ratchet, producing rotations by both forward and backward movement of trigger lever acting on side surface of large diameter of cylinder, using for the purpose pawls and ratchets."

81. For an *Improvement in Elastic Goods;* Edward Brown, Rindge, N. Hampshire.

Claim.—"I claim the within described elastic fabric, the india rubber being confined between two thicknesses of stocking work, in the manner and for the purpose set forth."

82. For an *Improved Neck Yoke;* Schuyler Briggs and J. G. Talbot, Sloansville, N. Y.

Claim.—"We claim making two or more sections of a screw on each of the rods which carry the end rings in combination with the nuts in the bar of the yoke, so that it may be used with one end short and the other long, or both ends either long or short, as may be necessary or desirable."

83. For an *Improved Hot Air Furnace;* Gardner Chilson, Boston, Mass.

Claim.—"I claim the arrangement and employment, with respect to a fire pot or chamber, of one or more cones or tapering tubes, without descending bends or flexures, and having their eduction opening or openings made to carry off the non-combustible volatile products, and to retain nearly if not all the volatile combustible products, while the external surface or surfaces of such tube or tubes are exposed to freely radiate heat, the same serving to generate a large amount of heat, and securing a great economy in the consumption of fuel. And, in combination with one or more such tapering tubes made to communicate with the fire chamber, I claim a conical or tapering radiator, closed at top, and arranged directly over the fire, and made to open near its base in the said tapering tube or tubes, and to operate with respect to them and the fire pot or chamber, and the surrounding air or medium to be warmed or heated. I also claim the combining with the upper part of the fire pot, or the rim over the fire pot, and with the

exterior cones or radiators, the conical or partially conical bases or semi-cones attached to and making part of the rim, the same serving not only to facilitate the entrance of smoke and heat into the conical radiators, but the absorption of heat and its radiation towards the floor, and the reflection of heat into the tapering radiators. Also, arranging the feed or fire place door within the trunk or mouth piece, to the fire pot or place, and so as to operate as specified ; and, in combination with the mouth piece and the door, arranged in it as specified, I claim the passage in the mouth piece and its plate, for the thin sheet or stratum of air to pass under the door, (while it is wholly closed,) and said plate, and can be heated by contact with the plate before it (the said air,) reaches the fuel. And, in combination with the inclined door of the fire place, the plate, and the air passage directly under it, I claim the ledge or flanch, arranged as described, the same being not only for the purpose of regulating the admission of air into the passage, but of keeping it from passing under the door and over the plate while the ledge is below the level of the top surface of the plate. I also claim the arrangement of the register hole, (viz: in line of or axially with respect to the shaft of the grate,) in combination with the arrangement of the outer end of said shaft, viz: entirely within the throat of the ash pit, or in rear of the registry plate or opening, the said arrangement not only enabling me to dispose of the grate shaft entirely within the ash pit mouth, but to make the registry opening answer the purpose not only of admitting air to the fire when required, but of enabling a person to place a key or crank upon the shaft, for the purpose of turning or moving the grate when necessary, and this without danger of ashes escaping out of the ash pit, provided its door be closed."

84. For an *Improvement in Clasps for Loom Harness;* G. Copeland, Danville, Me.

Claim.—"I claim the clasp, formed of two plates having holes to receive the strap and catches or teeth, or other analogous projections, to catch the harness shaft or rail."

85. For an *Improvement in Knitting Machines;* J. A. Corwin, Newark, N. Jersey.

Claim.—"I claim, 1st, The tool on which the loops are formed and interwoven, consisting of two pieces terminating in hooks or barbs, or other equivalent thereto, and so combined that when motion is given to said pieces, one of the hooks shall seize the loop last deposited, and retain it, while the other shall take up and cast off the loop of the previous course, whereby the two become intertwining, and a netted fabric formed. 2d, The flanch, or any equivalent for making a recess or groove upon the sides of the plate or shank of the horn, whereby a space is made for the point of the take-up hook to pass behind and seize the loop, as described."

86. For an *Improved Parrel and Bow;* John Dane, Portsmouth, New Hampshire.

Claim.—"I claim the construction, arrangement, and combination of the said upper and lower semi-bands with the side pieces or supporters, together with the parrel bow, to which the yarn is secured."

87. For an *Improvement in Bedstead Fastenings;* J. Drayton, Buffalo, New York.

Claim.—"I claim the manner of fastening the end rails to the posts by means of the curved or crooked tenons, in combination with the clamp and wedge for securing the side rails to the posts, as described."

88. For an *Improvement in Electric Clocks;* Alexander Hall, Lloydsville, Ohio.

Claim.—"I claim, 1st, Giving motion to the clock movement, and to the pendulum, by means of a beam and spring, said beam carrying and deriving its motion from the armatures of two electro-magnets, through which electric circuits are alternately closed and broken, and transmitting motion to the clock movement by means of clicks and ratchets, or their equivalents, and to the pendulum, by means of the spring which serves to maintain its isochronous vibration without regard to the strength of the current, and thereby make the clock keep perfect time, and serve to regulate a number of the electric clocks. 2d, The manner of closing and breaking the circuit of the battery, so as to make it pass through one and the other of the electro-magnets alternately, by means of wedge-shaped points, of silver or other metal, which are caused to vibrate by the movements of the pendulum, and pass between small posts of suitable metal attached to permanent magnets, or other conductors, which form parts of the separate circuits through the two electro-magnets. 3d, Securing the connexions which close the separate circuits when they are made by means of two pieces of soft iron, which vibrate in connexion with the wedge-shaped pieces, or other equivalent means of closing the circuit, and are brought, when the circuit is closed, into contact or nearly into contact with permanent magnets."

89. For an *Improvement in Railroad Car Seats;* William Graham and Lawrence McLaren, Philadelphia, Pennsylvania.

"The nature of our invention consists in the double movement of the car seat, and so arranged as to face either end of the car that may be required, by simply shifting the back."

Claim.—"What we claim is, the levers, in combination with the leg rests and the movable seat."

90. For an *Improvement in Chair Frames;* Moses E. Halsey, City of New York.

Claim.—"I claim the construction of the back of a chair, by combining with each post and with the back rail of the seat, a supplementary post sustained and braced."

91. For an *Improvement in Machines for Adding Numbers;* Aaron L. Hatfield, Lewisburgh, Pennsylvania.

Claim.—"I claim the slotted reckoning lever with the spring ratchet attached; the disk D, with its sunken teeth, the curved disk C, with slots cut in the curve; the outer disk and lining with springs; the disk E, with its sunken teeth, cam, and steady pins."

92. For an *Improvement in Whiffle Trees;* Thomas Hardman and Albert Vose, Pittsfield, Vermont.

Claim.—"We claim the use of the iron fastening in the gain or slot, by means of a slide or catch."

93. For an *Improved Machine for Paging Books;* H. Hochstrasser, Philadelphia, Pa.

Claim.—"I claim, 1st, The adjustable escapement; and, 2d, The roller, in connexion with the spaces."

94. For an *Improvement in Platform Scales;* J. F. Keeler, Cleveland, Ohio.

Claim.—"I claim, 1st, The raising or lowering of the platform scales simultaneously at all points without regard to the position of the weight upon the platform, the weighing levers being retained in their proper places for weighing, and preserved from swaying about while the raising and lowering is being done by the intermediate platform or frame. 2d. The combination of the spring balance with the platform scales, arranged in the manner described."

95. For an *Improved Safety Lamp;* Chas. R. Landmann, City of New York.

Claim.—"I claim the use of the pendulum or swinging shaft, in combination with the balance rod. (having a re-action spring in connexion therewith,) and camphene or other explosive fluid lamp."

96. For an *Improvement in Machinery for Felting Hats or Hat Bodies;* J. B. Laville, Paris, France; patented in France, Aug. 29th, 1852.

Claim.—"I claim arranging the two series of rollers mounted in separate frames held or pressed together; but this only I claim when the two series of rollers have a continuous rotary motion, and a longitudinal reciprocating motion, the two series moving in opposite directions. Also, in combination with the two series of rollers for felting hats, the mode of supplying hot water to the two surfaces of the hats as they are passed through the machine, as described."

97. For an *Improvement in Connecting a Series of Car Brakes;* Paul Moody, Camden, New Jersey.

Claim.—"I claim the arrangement of bent levers at each end of every car, having their longitudinal arms projecting beyond the ends of each car, in such manner that when the cars are coupled together, the faces of each opposing arm shall come into contact, and without any fastenings, form a continuous mechanism for operating the brakes throughout a train."

98. For an *Improvement in Running Gear of Locomotive Engines;* Septimus Norris, Philadelphia, Pennsylvania.

Claim.—"I claim in a locomotive engine not having more than one pair of flanched driving wheels, the combination with the driving wheels of one or more pairs of flanched guide wheels, to keep or aid in keeping the engine upon the rails, when the driving and guide wheels are so arranged that while running upon a straight rail the former shall carry the load, and the latter act as guides."

99. For an *Improvement in the Spring to the Knives of Straw Cutters;* J. B. Stockton, Warren County, Kentucky.

Claim.—"I claim the construction and arrangement of the adjustable double spring guide, the moving and the fixed cutters, whereby the moving knife is held up to its work, whether the resistance opposed to it be at the middle, or at either end."

100. For an *Improvement in Harvesters of Grain and Grass;* J. J. Weeks, Oyster Bay, New York.

Claim.—"I claim, 1st, The track clearer, constructed in the form of a spiral or screw, and arranged and operating as described. I claim having each tooth of the sickle work through two of the fingers, in combination with the beveling of the cutting edges of every alternate tooth, so that while one tooth shall have its cutting edges on its upper face, that next to it shall have its cutting edges on its lower face."

101. For an *Improvement in Washing Machines;* M. D. Wells, Morgantown, Va.

Claim.—"I claim the construction of the rubber with a flanch at bottom."

102. For an *Improvement in Washing Machines;* Joel Wisner, Aurora, New York.

Claim.—"I claim the compound spindle, composed of the socket and spindle, for diminishing the amplitude of the vertical movement required in lifting in and removing the rubber, and preventing the binding incident to the said operations when a single spindle is used."

103. For a *Machine for Cutting Irregular Forms;* Arad Aldrich, Princeton, Assignor to John L. Cooper, Worcester, and Arad Aldrich, Princeton, Massachusetts.

Claim.—"I claim, 1st, The making an expansible cutter consisting of two or more parts revolving in the same place, yet capable of separation in the line of their axis. 2d, The combination of the cutters and governing apparatus, when said governing apparatus consists or is formed by slides or surfaces corresponding to the outline of the form required, taken from two or more sections at right angles with each other, as described."

104. For an *Improvement in Uniting Bats for Making Seamless Felt Garments;* D. W. Gitchell, Rahway, N. J., Assignor to John C. Wagstaff, City of New York.

Claim.—"I claim the use of glue, or other equivalent connecting substances, as a means of holding together the surfaces until they can be thoroughly united by the felting process, as described.

105. For an *Improvement in Processes for Making Illuminating Gas from Wood;* W. P. M'Connell, Washington, D. C.

Claim.—"I claim the improvement herein described, in making gas from wood, viz: subjecting the products of destructive distillation therefrom, to a high degree of heat."

Re-Issues for September, 1854.

1. For *Improvements in Pumps for Elevating Water Mixed with Mineral Substances;* William Ball, Chicopee, Massachusetts; dated September 12, 1854; original patent dated December 23, 1851.

Claim.—"I claim the improvement by which the waste, auriferous, or earthy water that leaks out of the shaft hole of the case A, is saved and returned into the body of the case, and the wear of the shaft hole of the chamber prevented; the said improvement consisting in the chamber, the collar, and the passage, as combined together, connected with the case, and the shaft of the fan wheel. 2d, I claim the rings, as constructed and applied to the interior of the pump, for the purpose set forth."

2. For a *Method of Applying Water to Compound Buckets of Flutter Wheels;* David Rankin, Augusta County, Georgia; dated September 26, 1854; original patent dated July 11, 1854.

Claim.—"I claim the so arranging of cuneiform buckets upon the radial arms of flutter wheels, as that in passing through an eccentrically formed water way, three buckets shall receive the volume of water in about the proportions described."

Design for September, 1854.

1. For a *Mole Trap;* Henry Fry, Assignor to Samuel Maxwell, Cincinnati, Ohio; dated September 12, 1854.

Claim.—"I claim the ornamental design."

OCTOBER 3.

1. For an *Improvement in Paddle Wheels;* Abner Chapman, Fairfax, Vermont.

Claim.—"I claim a parallel wheel, composed of a double series of segments, curved in opposite directions, and so arranged as to form continuous waved lines, when this is combined with the unbroken open space between said series."

2. For an *Improvement in the Form of Gas Retorts;* Charles M. Cresson, M. D., Philadelphia, Pennsylvania.

Claim.—"I claim the construction and use of a gas retort with a cellular shell or exterior wall, instead of the usual solid shell or wall; the cells being made to communicate with each other, and with the interior, so as to form either one consecutive series, or several collateral series of communicating cells."

3. For an *Improvement in Steam Gauge;* Victor Beaumont, City of New York.

Claim.—"I claim the peculiar variety of the shape of the so-called flattened spheres, consisting in conical surfaces combined together, so that when the pressure is extending the one, it is compressing the other."

4. For a *Machine for Manufacturing Frames of Wood Saws;* Thomas Batchelder, Candia, New Hampshire.

Claim.—"I claim the combination of the series of rotary chamfering cutters, the bridge or bottom rest, the side rest, the back and fore stops, for the purpose of enabling a person to perform the operation of chamfering each edge of a bar, and forming the chamfer with two tapering ends of a determinate length."

5. For an *Improvement in Brick Machines;* P. S. Devlan, Reading, Pennsylvania.

Claim.—"I claim the manner of actuating a number of plungers by the cranks attached to the eccentric pin upon the stationary journal or axis, by which I am enabled to adapt the well known toggle joint pressure in a simple yet effective manner, to a number of moulds in a revolving brick press."

6. For an *Improvement in Circular Stone Saws;* R. Deering, Sen., Louisville, Ky.

Claim.—"I claim constructing a circular stone saw of sectors of a circle, cut out of rolled or sheet metal in such manner, and in order that the fibre of the metal may be made to run radially through the centre or thereabouts, of each sector, and thus present an end fibre cutting edge all around its periphery."

7. For *Improvements in Warming Houses by Steam;* S. J. Gold, New Haven, Conn.

"The object of this apparatus is, the heating of buildings by radiation from broad, thin chambers, made the receivers and condensers of steam generated in a suitable boiler connected with the heaters, and otherwise arranged."

Claim.—"I claim, 1st, The combination of generater, radiator, and condenser, for the purpose of heating buildings, when the connexion between the generator and condenser is perforated so as to admit of the formation of a hydrostatic column, balancing the pressure of steam on the valve, and permitting the water from the condensation of the steam to return to the regenerator. 2d, The mode of regulating the quantity of steam admitted to the radiator by means of the valve and tubes. 3d, The method of producing a steam-tight connexion between the plates of the condensing and radiating chambers, by means of a card packed between the edges of the plates. 4th, The securing of the thin metallic sheets forming the chambers, by depressing and riveting, for giving the requisite strength to withstand the outward pressure of the steam in a simple and economical manner."

8. For an *Improvement in Drying Cloth;* R. L. Hawes, Worcester, Massachusetts.

Claim.—"I claim the combination of the steam cylinder with the hoops of tenter hooks, when said hoops, after being adjusted to any desired width of cloth on the cylinder, shall move with and have no motion independent of said cylinder."

9. For an *Improvement in Fastenings for Garments;* T. J. Harris, Jr., City of N. Y.

Claim.—"I claim the new manufacture of a button, having an eye capable of being conveniently opened and closed."

10. For an *Improved Dumping Car;* John Kimbel, Zanesville, Ohio.

Claim.—"I claim supporting a single body by bearers depending from the same, and resting on opposite faces of double inclined planes, so that the load may be discharged on either side at pleasure, and the bed returned to a horizontal position, without the aid of windlasses, chains, or other mechanical devices."

11. For an *Improvement in Knitting Machines;* James Y. Leslie, Cincinnati, Ohio.

Claim.—"I claim the combination of the lifting pins with the teeth, provided with grooves for receiving the lifting pins, that the range of loops may be pushed over the pins, and with hooks to hold the crimped thread whilst the range of loops are lifted up and discharged over the said hooks. I also claim the bar termed the presser, in combination with the range of teeth and lifting pins, for the purpose of forcing the range of loops over the said lifting pins, after they have been let down into the grooves of the teeth. And I also claim, in combination with the hooked teeth and lifting pins, the discharging bar, for discharging the range of loops from the lifting pins, after they have been lifted up over the hooks on the teeth. And also, in combination with the hooked teeth, the employment of the thread layers, having a motion downwards and forwards, for the purpose of crimping the thread between the teeth, and forcing it under the hooks by one and the same motion. Also, the employment of movable and adjustable stops, in combination with the thread carrier or carriers, for the purpose of determining the width of fabric to be knitted, and narrowing and widening the same."

12. For an *Improvement in Pen and Pencil Case;* J. J. Lounds, City of N. York.

Claim.—"I claim the slotted tubes, pencil tube, and pen holder; two tubes having enlarged or expanded ends, and the tube and pencil holder having contracted ends, for the purpose of causing the tubes, pen holder, and pencil slide to work snugly and without unnecessary play or looseness."

13. For an *Improvement in Brick Machines;* Francis H. Smith, Baltimore, Maryland.

Claim.—"I claim the flat, square, or triangular bar for pulverizing the clay. Also, in contradistinction from a metallic step, a step composed of wood and iron combined. Also, the open portable mould frame with a projecting flanch, said mould resting on a single detached plate for a bottom, and so that when the mould is thrown on the floor, the brick does not at the same time come in contact with the ground, because the flanches interfere, the concussion being just sufficient to give it a start. when it slips easily afterwards from the moulds."

14. For *Improvements in Machines for Dressing Stone;* William H. Robertson, Hartford, Connecticut.

Claim.—"I claim, in combination with a series of cutters or chisels, applied respectively to levers operated by a set of cams, the turning stop or adjustment bar applied to the chisel carriage. I further claim, in combination with the movable frame, the chisels and the mechanism for imparting to them their up and down movements, a sliding carriage and mechanism for imparting thereto short and reciprocating endwise or lateral movements, in order that the chisels may be made to cut the stone without producing ridges between the parts. I further claim the combination of the series of catch springs or bars with the chisel levers and their carriage."

15. For an *Improvement in Self-Acting Mules;* Wanton Rouse, Taunton, Mass.

Claim.—"I claim communicating rotary motion to the spindles, and governing the said motion in backing off and winding on the yarn during the progressive stages of the building of the cops, through the agency of a double inclined table, having either a rectilinear motion or a circular motion, with every portion of its face moving in a plane, the said table transmitting motion to the shaft which drives the spindle through any mechanical means whereby the desired result can be produced."

16. For an *Improvement in Making Hat Bodies;* Andrew Rankin, Newark, N. J.

Claim.—"I claim, 1st, The combination of the bowing apparatus with the picking cylinders. I also claim the hurdle, having layers of silk, or other material, between the upper and lower perforated material around the edges. I also claim the employment of the transparent cone for setting up and stopping off hat bodies."

17. For an *Improvement in Curtain Fixtures;* Silas S. Putnam, Boston, Mass.

Claim.—"I claim my improved self-fastening curtain roller bracket, as made with a spur, or its equivalent, projected from below the axis of the curtain roller, in combination with a rest or arm extending above the same, and so that said spur and arm may be applied to the opposite of a sash groove, and be made to hold the curtain roller in place."

18. For an *Improvement in the Manufacture of Daguerreotype Cases;* Samuel Peck, New Haven, Connecticut.

Claim.—"I claim the improvement in the manufacture of picture cases or articles, from a composition of shellac and fibrous material, the same consisting in making said case or article of the said composition, and one or more sheets of paper, and pressing and combining the whole together in a press or between dies, so that the paper shall combine or connect itself directly with the composition without the aid of any cement interposed between them, and serve to add great strength to the article so made. And I claim the improvement of ornamenting the surfaces of the impression of the die with burnished gold, the same consisting in applying the gold to the surface of the sheet of paper, or its equivalent, burnishing it while on said surface, and laying the said burnished surface in contact with the surface of the die, and pressing said paper and the plastic composition together and into the die, so as to force the burnished gilding, paper, and composition upon it, and produce the result, as specified. I also claim the extension of the paper up the inner surfaces of the sides of the case, and by means of the pressure in the mould, the same being for the purpose of enabling me to affix to the side the velvet covered frame for the support of the picture, the mat, and the glass thereof."

19. For an *Improvement in Apparatus for Starting Railroad Cars;* William Palmer, City of New York.

Claim.—"I claim the apparatus for starting railroad cars, consisting of the ratchet wheels attached to the car wheels, acted upon by the spring pawls situated within the slotted bars, which are connected by suitable frame work with the draw bar, the whole being so arranged that on starting, the traction of the said draft bar shall be directly upon the top part of the wheels until the pawls are thrown out of gear, and on stopping the car, the draft bar shall be pushed back, hereby setting the pawls for starting again."

20. For an *Improvement in Brick Machines;* Z. M. Paul, Alexandria, Louisiana.

Claim.—"I claim the construction and arrangement of the two mould cylinders, which work in close connexion, one with the other, to wit: forming the intervening blocks between the moulds of quicker convexity than is due to the circle which would circumscribe them, and so arranging the said blocks and moulds of the two cylinders, that they alternately mesh one into the other, whereby the outer face of the brick will be left straight, and the brick be hard pressed in the moulds of either cylinder, alternately in continuous succession. I also claim ejecting the brick from the mould, by percussion or sudden jerk applied to the platen by means of the releasing frame."

21. For an *Improvement in the Feeding Hoppers of Threshers and Separators of Grain;* Spencer Moore, Central Bridge, New York.

Claim.—"I claim the employment of the flap or swing blind, guard board, and shoulder."

22. For an *Improved Pen and Pencil Case;* John Mabie, English Neighborhood, N. J.

Claim.—"I claim having the pencil slide fitted within a tube which is secured permanently within the case, the tube B having a spiral slot cut through it at its upper end, encompassed by a tube F, also having a spiral slot cut in it in a reverse direction to the slot in the tube B, the pencil slide being provided with a pin which passes through the two slots, and which is operated upon by turning the tube F, so that the pencil slide is forced into or out from the case."

23. For an *Improvement in Railroad Draw Bridge and Switch Telegraph;* Wm. C. McRea, Philadelphia, Pennsylvania.

Claim.—"I claim the giving of a signal on a car or locomotive, by the arrangement of an electro-magnet upon said car or locomotive, in such a manner as to constitute part of a galvanic circuit when the wheels of the car or locomotive touch an insulated portion of the track while the train is in motion, thereby causing the electro-magnet to be

acted upon by a distant battery for giving said signal. I also claim attaching the wires of a galvanic circuit at railroad draw bridges or switches, in such a manner that the opening of the draw or changing of the switch may separate a part of the wire of said circuit, and closing the draw or replacing the switch, shall again complete the connexion of that part of the wire which was so separated, when used in connexion with the before specified arrangement for signalizing on the car or locomotive when in motion, the completion of the circuit."

24. For an *Improvement in Mosquito Curtains;* Benjamin B. Webster, Boston, Mass.

Claim.—"I claim so combining a musquito curtain with a window, that it may be attached to the sash of the window, and a roller applied to the window frame, and be operated by said sash, and so as to close the opening produced by the raising of said sash, the said curtain being wound upon the roller by the action of a spring, or its equivalent, when the sash is in the act of being closed."

25. For an *Improved Printing Press;* Ervin B. Tripp, Concord, New Hampshire.

Claim.—"I claim giving the necessary feed motion to the press by means of the reciprocating tympan and frisket, nipper bar, cylinder, and guides. 2d, I claim the employment or use of the endless belt with oblique rollers placed thereon, and arranged with the ink fountain and rollers, for the purpose of equally distributing the ink upon the rollers."

26. For an *Improvement in Processes for Purifying Fatty Bodies;* Richard A. Tilghman, Philadelphia, Pennsylvania; patented in England, Jan. 9th, 1854.

Claim.—"My invention consists of a process of producing free fat acids and solution of glycerine from those fatty or oily bodies of animal and vegetable origin, which contain glycerine as their base. I claim the manufacturing of fat acids and glycerine from fatty bodies, by the action of water at a high temperature and pressure."

27. For an *Improvement in Movements of Gas Metres;* J. Thatcher, Philadelphia, Pa.

Claim.—"I claim operating the index of gas metres by means of the lever adapted to move or slide against a controlling pin or fulcrum, or its equivalent, the measuring wheel and index movements being connected with the lever by means of the crank, or their equivalents."

28. For an *Improvement in Looms;* Joseph Welsh, Philadelphia, Pennsylvania.

Claim.—"I claim the application to the lay of those looms requiring or having a moving shuttle box, a periodically moving shuttle stopper, which receives its motion from any suitable part of the loom, and independently of the picker and shuttle box, or either of them, and continues so to act as to arrest or stop the motion of the shuttle, without injury to the same or to the box, on its arrival within the said box, and then immediately turns or moves from the same, so as to allow a perfectly free and independent motion of the box, and also of the picker, during the working operation of the loom."

29. For an *Improvement in Sewing Needles;* John Wilcox and Stephen H. Whitridge, Philadelphia, Pennsylvania.

Claim.—"We claim a sewing needle, the stem or body of which is made of gold, and the point of iridium, the two metals being reduced and united."

30. For an *Improvement in Hot Air Furnaces;* John E. Grant, Charlestown, Assignor to Cyrus Carpenter and Augustus D. Shaw, Boston, Massachusetts.

Claim.—"I claim the deflecting plate with its saddle flanch, when interposed in the combustion chamber between the products of combustion and exit pipe."

31. For an *Improvement in Piano Forte Stools;* Levi Van Hoesen, Assignor to the 'New Haven Iron Railing Company,' New Haven, Connecticut.

Claim.—"I claim the combination of the part (with its serrated or notched edges,) with the double acting dog, when the dog is operated by the bar."

MECHANICS, PHYSICS, AND CHEMSTRY.

For the Journal of the Franklin Institute.

On an Improved Mode of Producing Draft in Marine Boilers Burning Anthracite Coal. By J. VAUGHAN MERRICK.

(Patented May 6th, 1854.)

The use of anthracite coal in marine boilers depending on natural draft for combustion, is attended with the difficulty that in smooth calm weather, or light favorable winds, or at the time when circumstances favor a rapid passage, the draft is deficient, and the supply of air to the fire rooms diminished, causing a reduced production of steam. What is termed "natural draft," is traceable to two causes; 1st, The rarefaction due to the elevated temperature of the gases in the chimney; and, 2d, The influence of winds, &c., in supplying air for combustion, or in their effect on the contents of the chimney. It is this latter element which is so variable, and which has generally caused the introduction of blowers for use in calm weather.

These blowers are generally placed below, in the fire rooms, or between the boilers, and the nozzles conduct the air below the fire room floors into channels leading under each furnace door. These channels are provided with traps, by which they may be shut off when fires are cleaned. Now, the use of blowers with forced blast, is attended with serious inconveniences, among which are, the great power expended in driving them; a rapid destruction of the furnaces, caused by the intense local heat; waste of fuel, expense of construction, &c.; besides which, it is requisite to raise the boilers high enough to get the air channels under the floor, which, with return tubular boilers, is a serious evil. These objections, which may fairly be advanced against blowers, cannot be charged against exhausting fans, which produce an effect similar to that of natural draft.

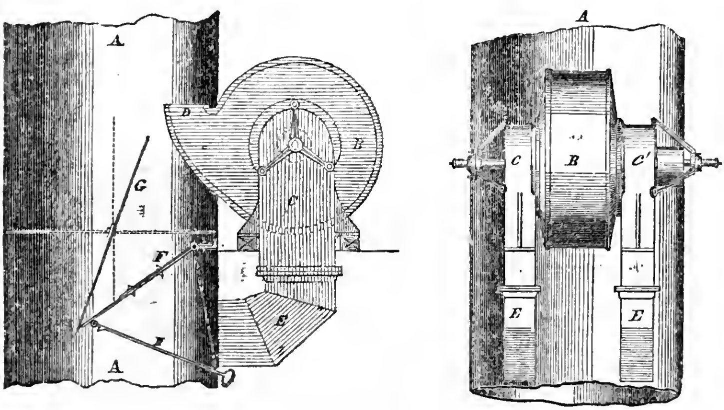
Exhausting fans are not a new device for the purpose of producing draft. Peclet describes and illustrates a plan for using them in stationary boilers. Captain Ericsson also used them, and applied one to the auxiliary screw steamer *Massachusetts*, which is the only case within my knowledge wherein they have been employed in marine boilers.

About ten months ago, it became an object to increase, at times, the evaporative power of the boilers of the steamship *Keystone State*, which, although amply large in ordinary weather to carry high steam, would not supply to the required extent in calm weather. The use of fan blowers for forced blast was considered objectionable for reasons previously given. The use of steam jets was not advisable, as the engine has a fresh water condenser. The only remaining plan was an exhausting fan. But it was necessary to have this fan so arranged that when not in use, the boilers should be in their original condition, and that when in use it could be easily accessible. The plan adopted by Capt. Ericsson in the *Massachusetts*, where the blower case was built in the body of the chimney, does not fulfil either of these conditions; besides which, the chimney of the *Keystone State* was already in place; and, whatever plan was adopted,

had to be applied in a very limited period of time. To fulfil all the desired conditions, I designed the arrangement hereafter described; and, in order to show the effect produced by the fan, have waited till a careful experiment could be made, of which the results are given below.

The fan is 4 feet diameter, 2 feet wide, with passages 2×2 feet, is supported on the hurricane deck, and placed forward of the stack. It is driven at about 500 revolutions per minute by a vertical non-condensing engine, with cylinder 8 inches diameter, and 1 foot stroke, the belt carried round the fly wheel; the engine makes one revolution to five of the fan. The whole space occupied by fan, engine, belting, &c., is 8 feet square, and the whole of the machinery is protected by a house, similar in appearance to the pilot house. It has been in use whenever required, since January last, and was entirely successful in the object for which it was put up. As the number of revolutions of the fan is limited, the evaporative power of the boilers would not be increased in head winds. But its effect in smooth weather is exactly what was intended, viz: to supply the deficiency of draft. Of course, it is not claimed that the economical efficiency of the boilers is increased, but simply their evaporating power.

Description.—The fan of the *Keystone State* is represented in the accompanying illustration:



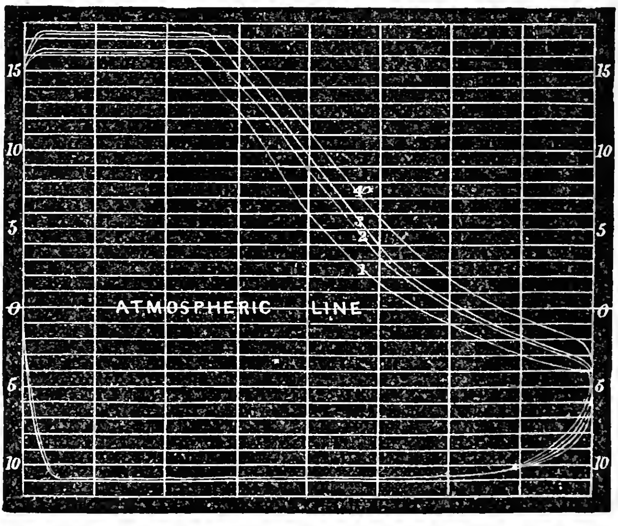
References, A, smoke pipe.
B, fan.
C C, inlet boxes.
D, outlet.
E, inlet pipes.
F, hinged valve or deflector.
G, damper of stack.
H, handle for regulating inlets, &c., of fan.

When the fan is out of use, the valve, F, is lowered to the position shown in dotted line, against the forward side of the stack, covering the inlet openings, E, to the fan, and shutting it off, so that it is not heated

by the passage of the gases, &c., and may be oiled or adjusted; while the damper, G, is placed so as to regulate the draft, as usual.

When the fan is in use, the valve, F, is raised to the position indicated in full lines, the damper, G, placed vertically, or nearly so, its lower side being against the valve. The ascending current is thereby divided into two portions. That on the forward side striking the valve, is deflected into the fan, whence it is ejected upwards at an increased velocity into the stack, thus forming a current which draws with it the other portions of the gases, passing up the after side of the stack, and the whole mass has its velocity increased, or, in other words, the natural draft is intensified.

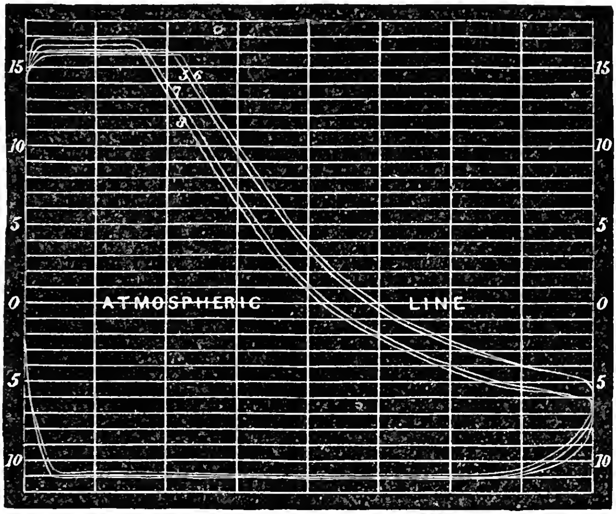
Results Obtained.—To ascertain how much the evaporation was increased by this device on board the *Keystone State*, the engineer chose a day of settled weather, with very light winds on the quarter, and run the fan one watch of four hours, noting the whole number of revolutions made by the engine, and maintaining a uniform (or nearly so,) pressure of steam in the boilers, by adjusting the cut-off; at intervals of 45 minutes, four indicator cards, marked 1, 2, 3, and 4, were taken, an average of which will give the mean performance throughout the whole period. The blower was then thrown off, and the same particulars noted for the next four hours, the four cards marked 5, 6, 7, and 8, being taken at similar intervals. An inspection of these diagrams will show that during the use of the fan, the cut-off had constantly to be lengthened, showing that the fires were improving; while, during the last watch, the cut-off had constantly to be shortened, showing that although the fires were left in good condition, they were constantly deteriorating. It is evident that a more prolonged trial would have shown an apparent gain by the use of the fan, much greater than that obtained.



Indicator diagrams taken on the engine of the *Keystone State*, Oct. 28th,

1854. Cylinder—diameter 80 inches; stroke, 8 feet; dip of wheels, 4 feet 7 inches; temperature of hot-well, 120°.

(For further particulars, vide *Journal*, vol. xxv., 3d Series, p. 139.)



With the Fan.

Cards.	Time.	Steam in boilers in pounds.	Vacuum per gauge in inches.	Av. revs. per minute.	Cut-off in feet.	Initial pressure in cylin.	Mean press. in cylinder.
No. 1.	9·15 A. M.	18·	24	15·60	2·33	16·25	17·36
No. 2.	10 "	17·75	24	15·65	2·55	16·50	18·40
No. 3.	10·45 "	18·50	24	16	2·60	17·25	18·98
No. 4.	11·30 "	18·50	24	16·14	2·80	17·33	19·91
Means,		18·19	24	15·69	2·57	16·83	18·66
			Without the Fan.				
No. 5.	1·15 P.M.	18	24	15·	2·00	15·75	15·80
No. 6.	2 "	18	24	15·	2·20	16·25	16·10
No. 7.	2·45 "	18	24	14·50	1·65	16·50	15·17
No. 8.	3·30 "	18	24	14	1·60	16·75	14·88
Means,		18	24	14·90	1·86	16·31	15·49

Revolutions during first watch, 3766; revolutions during second watch, 3575.

Comparison.—To compare these results, it is evident that we must compare the amounts of water evaporated, which are in proportion to the number of revolutions, and the portion of stroke performed before steam is cut off, (added to the clearance,) divided by the volume of steam at the initial pressure given in the last column but one of the above tables.

This clearance at each end of the piston amounts to 0·23 feet, by the area of the piston. Hence we have—

$$\text{With the fan } \frac{3766\times(2{\cdot}57+{\cdot}23)}{840} = 1255.$$

$$\text{Without the fan } \frac{3575\times(1{\cdot}86+{\cdot}23)}{853} = 870.$$

The numbers 840 and 853 being the respective volumes of steam at 16·83 and 16·31 lbs. per square inch.

Then 870 : 1255 : : 100 : 1·44, or, gain for whole period, 44 per ct.

To show the comparison at the time of the last observation in each watch, which would be more nearly a criterion than the mean performance, we have, (taking the average revolutions per minute, instead of the total number,)

$$\text{With the fan } \frac{16{\cdot}10\times(2{\cdot}80+{\cdot}23)}{829} = 0{\cdot}5880.$$

$$\text{Without the fan } \frac{14\times(1{\cdot}60+{\cdot}23)}{841} = 0{\cdot}3046.$$

Then, 0·3046 : 0·5880 : : 1·000 : 1·927 ; or, the evaporative effect was nearly *doubled*, and the speed of the ship (engine) increased as 14 : 16·10, or about two statute miles per hour. In the above calculations, no account is taken of the steam used by the engine driving the fan, which may be estimated as equal to about one-fourth the main cylinder full of steam per minute, and would amount to about $2\frac{1}{2}$ per cent. in the first, and 2 per cent. in the second case.

It is not claimed that these results would be at all extraordinary if produced by blowers in the usual manner; but when it is considered that they are produced with a very trifling expenditure of power, without waste of fuel, without any destructive influence on the furnaces, that both the fires and the blowing machinery are perfectly accessible for cleaning at all times, and, in short, that all the well known advantages of natural draft are combined with the power of nearly doubling the evaporation in calm weather, I think the results show an improvement sufficiently marked to be worthy a place in this *Journal.*

On the Effect of the Pressure of the Atmosphere on the Mean Level of the Ocean. By Captain Sir James Clark Ross, R.N., F.R.S.

The author states that, in September 1848, Her Majesty's ships *Enterprise* and *Investigator* having anchored in the harbor of Port Leopold, in lat. 74° N. and long. 91° W., a heavy pack of ice was driven down upon and completely closed the harbour's mouth, thus effectually preventing their egress, and compelling them there to pass the winter of 1848-49. It was during that period that the series of observations here presented to the Royal Society was obtained ; and, as the observations were made under peculiarly favorable circumstances, the author consid-

* From the Lond., Edin. and Dub. Philos. Mag., Oct. 1851.

ers they will throw some light on the movements of the tides, and on some of the causes of their apparent irregularities.

Soon after the harbor had been completely frozen over, a very heavy pressure from the main pack forced the newly-formed sheet of ice, which covered the bay, far up towards its head, carrying the ships with it into such shallow water that at low spring-tides their keels sometimes rested on the ground. Under these circumstances the movements of the tides became to the author an object of great anxiety, and consequently of careful observation, in order to ascertain the amount of irregularities to which they were liable in that particular locality.

The first few days' observations evidenced much larger differences in the elevation or depression of successive high or low-waters than could be accounted for by any of the generally received causes of disturbance; and the author was at once led to connect them with changes of the pressure of the atmosphere, from perceiving that on the days of great atmospheric pressure high-water was not so high as it ought to have been, and low-water was lower than its proper height; and that the reverse took place on the days of smaller pressure.

As it was found that the usual method of determining the mean level of the sea, by taking the mean of successive high and low-waters, was inadequate to the detection of small quantities arising from a change in the pressure, a system of observation was adopted different from that heretofore practised, in order to determine the mean level of the sea on each day.

In the first instance, simultaneous observations of the height of the tide and of the mercury in the barometer were made every quarter of an hour throughout the twenty-four hours. From these it was found that the mean level of the sea for each day could be determined with great accuracy, and that the variation in the daily mean level and in the mean pressure of the atmosphere followed each other in a remarkable manner, so that a rise in the former corresponded to a diminution in the latter. Subsequently, however, hourly observations were adopted.

The peculiar advantages of the position of the ships at Port Leopold for making tidal observations are stated to have consisted in:—

1. The great width of the entrance of the harbor admitting the free ingress and egress of the water, combined with the large field of ice which covered the whole of the bay, completely subduing every undulation of the water.

2. The steady movement of the immense platform of ice, rising and falling with such singular regularity and precision as to admit the reading off the marks of the tide-pole with the greatest exactness, even to the tenth of an inch.

3. The shallowness of the water and the evenness and solidity of the clay bottom admitting the fixture of the tide-pole with immoveable firmness.

4. The whole surface of the sea in the neighborhood being, for the greater part of the time, covered by a sheet of ice, preventing those irregularities which occur in other localities from the violence of the wind raising or depressing the sea in as many different degrees as it varied in strength or duration.

For fixing the tide-pole for the "*Enterprise*," a hole 2 feet square was cut through the icy platform, and a strong pole, nearly 40 feet long, was passed through it and driven firmly down several feet into the clay, being fixed by heavy iron weights, which also rested on the clay and prevented any movement of the pole. It was placed in about 21 feet depth of water at the time of mean level of the sea. Another such tide-pole was, in a like manner, fixed through a hole in the ice close to the "*Investigator*," for the sake of reference and comparison.

Hourly observations of the height of the tide and of the barometer were commenced on the 1st of November, and were continued by the officers of each ship throughout the whole of the nine following months to the end of July. After forty-seven days of observation, an interruption in one of the series occurred in consequence of the tide-pole of the "*Enterprise*" having been drawn up by the ice, to the under part of which it had become frozen. The amount of displacement of the pole was easily determined by a comparison with that of the "*Investigator*," but several days elapsed before it could be satisfactorily fixed at the same point in which it had been originally. The observations of these forty-seven days are those which are given in the paper, and their discussion is the immediate object of the communication.

It is stated that subsequent observations seem to show that, from the time of the interruption to the middle of July, there was a progressive elevation of the mean level of the sea, which, although of small amount, was sufficiently evident from month to month to render the subdivision of the series desirable, in order that the individual observations of each separate division should be strictly comparable.

The height of the sea and the corresponding height of the mercury in the barometer, at every hour in each day, from the 1st November to the 18th December, 1848, are given in tables. In these arithmetic mean of the hourly heights of the sea for each day is taken as the mean level of the sea for that day, and the mean of the hourly heights of the barometer is taken as the corresponding height of the barometer. These mean levels and corresponding mean barometric heights are given in another two-column table, arranged in the order of the days of observation ; and in a third table these are arranged in the order of the heights of the barometer with the corresponding mean levels, without regard to the dates of observation, for the purpose of showing the dependence which the latter have on the former.

On these tables the author makes the following remarks. The forty-seven days of hourly observations give for the mean height of the barometer 29·874 inches, and of the mark of mean level of the sea 21 feet 0·21 in.

The mean of three days *greatest* pressure was:	30·227, and of corresponding level	20 feet 8·4 inch.
The mean of three days *least* pressure was :	29·559, and of corresponding level	21 feet 5·4 inch.
	Diff. +0·668	Diff. —9·0

Thus a difference of pressure equal to 0·668 inch produced a difference of 9 inches in the mean level of the sea. As the ratio of 9 to ·668 is

13·467 to 1, the author considers that the effect of the pressure of the atmosphere on the level of the sea is 13·467 times as great as the effect it produces on the mercury in the barometer, or very nearly in the inverse ratio of the specific gravities of sea-water and mercury. He however states, that this remarkable coincidence must be considered in a great measure accidental, for if a greater number of days' observation be taken in order to deduce the mean greatest and mean least pressure, and the corresponding mean levels, a different result will be obtained. From these observations, however, he considers that he has been enabled to deduce results which plainly point to the law which governs the effect of the pressure of the atmosphere on the mean level of the sea, and may be encouraged to pursue the investigation through a more extended series of observations, in order to arrive at the most accurate conclusion that the observed facts may justify.

In conclusion, a formula is given for determining the correct height of the tide, or of the mean level of the sea:—

Let L denote the correct height of the tide, or of the mean level of the sea;
B the mean pressure of the atmosphere;
λ the observed height of the tide, or of the mean level of the sea;
β the corresponding height of the barometer;
D the ratio of the specific gravity of mercury to that of sea-water:
then $L = \lambda + (\beta - B)\ D$.

Examples are given of the application of this formula.

For the Journal of the Franklin Institute.

Remarks upon the Use of Phonic Signals in Navigation. By Prof. John C. Cresson, C. E.

Among the numerous suggestions, elicited by the melancholy loss of the steamer *Arctic*, for the prevention of such disastrous collisions, there is none that appears so easily attainable as the use of the steam whistle, or, more correctly, steam trumpet.

The proper mode of using this instrument being, therefore, a matter of some importance, a few remarks, based upon experimental knowledge, may be a not inappropriate contribution to the pages of the *Journal.*

It is well known that the blast of a large steam trumpet is distinctly audible at the distance of five miles, and instances are known of its being heard at more than twice that distance in cloudy weather.

It has been found, also, that this peculiarly abrupt sound is well adapted for the formation of distinct echoes, and at sea its echo from a bluff coast or a ship is very remarkable, so as to be quite startling when heard for the first time in darkness or fog. The writer took part in some trials of it on the Bay of Fundy, which proved that this echo would give notice of approach to a rocky headland, distant several miles, and of a small schooner more than a mile off.

May not these qualities of the steam trumpet be so applied as to make it not only give a warning signal to others outside the ship, but also to return the warning to the ship giving it? If so, how is it best to be accomplished?

Experiment has shown that a loud, abrupt sound, produces a complete impression on the sense of hearing, if its duration be only one-eighth of a second of time; and, further, that sound travels through the air at the rate of a sea mile in about five and a half seconds. A vessel running at twelve knots, passes over a sea mile in five minutes, so that two vessels three miles apart, running head on at this rate, would come together in seven and a half minutes. A consideration of these facts leads to the following practical conclusions as to the proper mode of using the steam trumpet in dark or foggy weather.

Instead of blowing it continuously for any length of time, it should be blown in short, abrupt blasts, with a considerable interval of silence, the length of which should be varied with the speed of the vessel, and other circumstances.

As a blast continuing an eighth of a second is audible, we may safely depend upon making a good impression on the ear, even at a distance, by giving it sixteen times that duration, or two full seconds. This could be heard at sea for the distance of five or six miles, and its echo from any large object above the horizon, would be audible when two or three miles off. The intervals of silence ought to be such that two vessels three miles apart could not come together between two consecutive blasts, if running right head on. If their united speed be not more than twenty-four knots, it will be quite safe to allow five minutes, as there would be at least two blasts returned by echo to the vessel making the signal, and many more audible to the watch on the other vessel, before they could come into contact.

The quantity of steam required for such use of the trumpet, would be less than one-hundredth part of that consumed in sounding it continuously; and even if the intervals between the blasts be reduced to two or three minutes, it would use but an insignificant amount of steam, probably not one-tenth of a horse power.

Another advantage accruing is, that this mode of signaling not only gives warning of approaching vessels, but also will make known the proximity of icebergs and headlands, or any other large object above the horizon; it may even, in cloudy weather, give warning of land many miles beyond the horizon, by means of the reverberation from the clouds to the land, and back by the same course.*

The interval of silence also allows the look-out man to hear any signal given by another vessel in reply to his own.

To obtain the best effect from the trumpet, it should be placed forward of the smoke pipe, elevated 20 or 30 feet above deck, and be provided with a bell-shaped reflector that will project the sound strongly forward, and limit its range to 60 or 90 degrees of azimuth.

The signal man should have his place of look-out at the bow of the vessel, where he should have a small pent-house screen or shelter directly

* A curious illustration of the reflexion of such sounds by clouds, has recently been observed upon a railroad in this State, which crosses one of the principal mountains in the anthracite coal field of Schuylkill county; the steam signals given by a locomotive in the Mahanoy Valley, north of Broad Mountain, being distinctly heard, in cloudy weather, at a station ten miles distant, on the south of the mountain. The height of the interposed mountain above the two points was over seven hundred feet.

above and behind him, so as to protect his ears from the intensity of the sound of his own trumpet, and thus preserve his acuteness of hearing for catching the feebler echoes returned by very remote objects. The accompanying rough sketch (Plate IX,) shows the arrangement of these things deemed most effective. A coarsely made time-keeper, with a strong chronometer escapement beating full seconds, should be provided and placed under the small pent-house, in view of the signal man, by the beats of which he may regulate the duration of his blasts, and the intervals of silence; and may also, by counting beats between a signal and its echo, estimate the distance of the echoing object. The right method of proceeding is this: at night, and in fogs, let the look-out man make his signals regularly, according to orders, say every four minutes, keeping up the sound for two seconds or beats of his time-keeper; the regularity with which he performs this, will be a good indication of his vigilance.

Should he at any time hear an echo, he must repeat his signal at a half interval, say two minutes, and immediately count the beats of his time-keeper until the echo is again returned. Should the time be long, say as much as thirty seconds, he will know that the stranger is about three miles off, and he may again give his blast in the half interval of two minutes; should the observed time of this third echo be as great as before, he must continue his signals at half intervals until he observes a change in the time of the return of the echo; should it become shorter, he must give his signal sooner, say at a quarter interval of one minute, and so on. Should the time of the echo become longer, he may lengthen his interval to three minutes, and if the echo ceases, he may return to his regular four minute interval.

The velocity of sound being, approximately, a sea mile in five seconds, and the echo requiring time to go and return, the distance of the echoing object is to be estimated at a mile for every ten seconds, or when greater accuracy is desired, it is to be taken at a mile for eleven seconds.

Now, let us consider for a moment the results of these proceedings. In the first place, the man on look-out has been giving notice to all on board that he is at his post, and awake, which satisfactory announcement will continue without change, so long as nothing above water nears the ship. As soon as there is anything ahead large enough to give an echo, the change of interval between the signal blasts gives immediate notice of the fact to the officer on duty, and all others on watch; the officer can at once make his own observations as to the nearness of the approaching object, and its rate of approach. Experience will soon enable him to judge pretty correctly with regard to its position, its size, and its general character, that is, whether it be a ship or an iceberg, a rock or a coast. The engineer having received the same warning, is prepared to stand by for stopping or reversing, and the helmsman is on the alert for orders to change his course.

A system of Phonic language may easily be devised for giving all the requisite information by approaching vessels of each other's course and intended movements. Railroad engine men have a very simple system of conveying such knowledge with great precision. Should the steam pressure of the engine be too low to produce an energetic blast, a small

furnace and boiler, occupying but half the space of a cook's galley, would furnish abundance of high steam.

On sailing vessels, a hand force pump or bellows for compressing air into a strong receiver, would answer every purpose.

As these abrupt trumpet blasts will be more unlike the ordinary sounds heard on ship-board at sea than a continuous sound would be, they will more effectually arouse attention, and this tendency might be further increased by making the blast suddenly change its tone, as is done in the Indian whoop, in which an abrupt rise in tone, to the extent of an octave or more, gives a peculiarly startling effect.

Philadelphia, Nov. 24th, 1854.

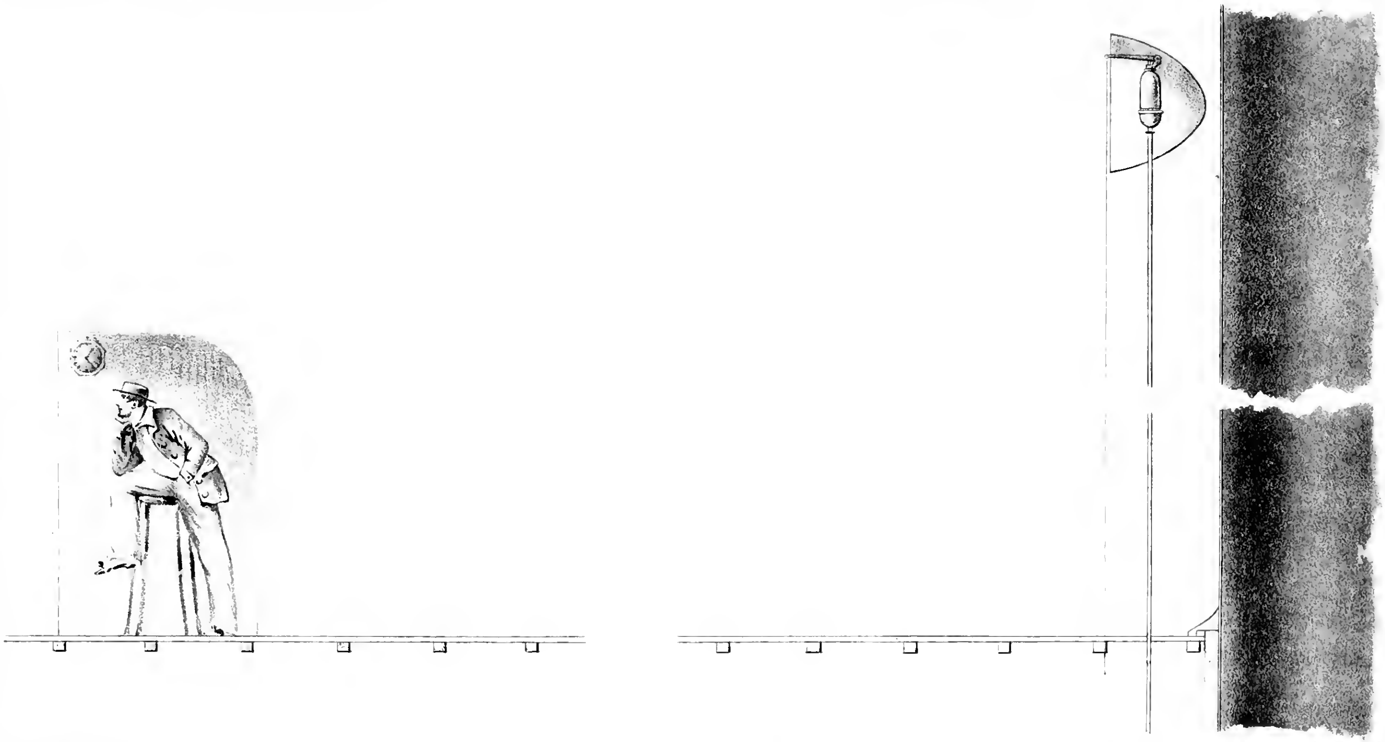
For the Journal of the Franklin Institute.

Particulars of the Steamboat Potomska.

Hull built by Capes & Allison, Hoboken. Machinery by Hogg & Delamater, New York. Intended service, New York and New Bedford.

Hull.—		
Length on deck, from fore part of stem to after part of stern post,	140 feet.	
Breadth of beam at midship section,	26 "	
Depth of hold,	8 "	6 inches.
Draft of water at load line,	9 "	
" " below pressure and revolutions,	10 "	
Masts and rig,	three masted schooner.	
Engine—Vertical direct.		
Diameter of cylinder,		34 inches.
Length of stroke,	2 feet	6 "
Maximum pressure of steam in pounds,	35.	
Maximum revolutions per minute,	54.	
Weight of engines,	20 tons.	
Boiler—One—Vertical—Tubular.		
Breadth of boiler,		6 feet 9 inches diam'r.
Height " 7½ diameter, 19½ feet high. Horizontal tubes, five outside of tubes.		
Weight of boiler without water,	8½ tons.	
Number of furnaces,	one.	
Number of flues or tubes,	587.	
Internal diameter of flues or tubes,		2 inches.
Length of flues or tubes,	4 feet	
Heating surface,	1500 sq. feet.	
Diameter of smoke pipes,	2 "	8 inches.
Height "	20 "	
Description of coal,	anthracite.	
Consumption of coal per hour,	⅓ ton.	
Propeller.—		
Diameter of screw,	9 feet.	
Pitch of screw,	21 "	
Number of blades,	4.	

Remarks.—Floors filled in solid under engine. C. H. H.



Translated for the Journal of the Franklin Institute.

A New Flesh Broth for the Sick. By Justus Liebig.

To prepare a portion for one person of this flesh broth, take a half pound of meat of some freshly slaughtered animal (beef or chicken,) chop it finely, and mix it well with eighteen ounces of distilled water, to which has been added four drops of pure hydrochloric acid and from a half to one drachm of culinary salt. After standing for an hour, the whole is thrown upon a conical hair sieve,* such as is to be found in every kitchen, and suffered to drain without the application of any pressure. The first cloudy droppings are returned to the sieve until it flows quite clearly. A half pound of distilled water is then thrown in small portions upon the residue in the sieve. In this way is obtained about a pound of liquid (cold extract of flesh,) of a red color and pleasant broth taste. It is administered to the patient, cold, by cups full at pleasure. It should not be heated, as it then becomes cloudy, and gives rise to a thick deposit of flesh-albumen, and hæmatin.

A young girl of eighteen years of age, having become sick in my house from an attack of typhus, gave occasion for this preparation, through a remark of my family physician, (Dr. Pfeufer,) that in a certain stage of this disease the greatest difficulty which is presented to the physician arises from the defective digestion, a consequence of the condition of the intestines; and besides, from the want of a suitable diet for digestion and the formation of blood. In fact, in the ordinary broth prepared by boiling, there are wanting all those very components of flesh that are necessary to the formation of blood-albumen, and the yolk of egg which is added is very poor in these substances, for it contains in the whole, $82\frac{1}{2}$ per cent. water and fat, and only $17\frac{1}{2}$ per cent. of a substance like egg-albumen, or a very similar substance, and whether this replaces flesh-albumen in its nutritive powers, is, according to Majendie's experiments, at least doubtful. Besides flesh-albumen, the new broth contains a quantity of hæmatin, and therein a far greater quantity of the iron for the formation of the blood corpuscles, and finally the digestive hydrochloric acid.

A great difficulty in the use of this broth is, that sourness arises from its undergoing change in warm weather; it enters regularly into fermentation, like sugar-water with yeast, without giving rise to a bad smell; the body thus formed is very well worthy of investigation. The extraction of the flesh must, therefore, be undertaken with quite cold water, and in a cool place. Ice water and external ice cooling remove this difficulty completely; above all, it is strictly to be cared for, that the flesh is *fresh, and not several days old.*

This broth has come into use in the present City Hospital (Munich) as well as in the private practice of several of the most distinguished of our physicians, as Doctors von Gietl and Pfeufer.

I would, perhaps, have hesitated about giving so simple a thing a greater publicity than it merits, had not a late, and for my family, important event, fully convinced me of the great nutritive power of this soup,

* Or such a strainer as is used in this country for calves-foot jelly. Trans.

and the natural wish arose that its use might be proved in larger circles, and that other sick might experience its beneficial effects.

A young married lady, who, in consequence of inflammation of the ovaries, could partake of no solid food, was kept exclusively upon this diet for two months, and to the perfect restoration of her health; during this time she improved perceptibly, both in flesh and strength.

The patients generally take the soup without any resistance as long as they are sick, but as soon as they can partake of other food, they refuse it, which, perhaps, arises from the color and slight flesh smell. For many, therefore, it might prove of use to color the broth brown by burned sugar. *Annalen de Chemie und Pharmacie.* Aug., 1854. VOL. XCI, p. 244.

On Baker's Furnace.

To the Committee on Publications:

BOSTON, MAY 18th, 1854.

SIR:—In consequence of the articles respecting Baker's Steam Boiler Furnace in your *Journal* for September and October, by Mr. Isherwood, I beg leave respectfully to submit the accompanying certificate, which answers any doubts as to the true value of the furnace; and I beg for it a place in your valuable *Journal.*

Respectfully, yours,

J. AMORY.

The undersigned having, at the request of Mr. Amory, the agent for Baker's patent boiler furnace, visited the blacksmith's shop at the Navy Yard, in Charlestown, for the purpose of observing the effect produced by the peculiar mode of setting steam boilers, in conformity with the said patent, as exhibited in the furnace which is in regular operation at that shop, respectfully submit the following statement:

Our attention was called to the prefatory remarks contained in a report made by Mr. B. F. Isherwood, and published in the *Franklin Journal*, of some comparative experiments on one of the said furnaces, at the Navy Yard in Washington, and on the furnace constructed under the direction of the Engineer-in-Chief at that Yard. In those remarks, Mr. Isherwood contradicts the fact asserted by Mr. Baker in the specification of his invention, that in the form of constructing what he calls "reverberating chambers," in combination with the fire places and boiler, "they are made to revolve and retain the volatile products underneath the boiler long enough to be consumed." This allegation of Mr. Baker's specification is controverted by Mr. Isherwood, by various arguments, in the course of which he uses the following language:

"As far as regards the revolving and retaining of the heated gases by means of the arches, it is quite certain these gases will not be at all *revolved* or retained, but instead of following the shading in Fig. 2, representing their course, according to Mr. Baker, they will follow in a straight line, taking the shortest and most direct route from furnace to chimney, and leaving the arches beneath the dotted line, Fig. 2, filled with quiescent gases. In a word, the reverberating chambers of Mr. Baker do not reverberate, and cannot, as arranged, be made to do so."

We are not called on to reply to the argument of Mr. Isherwood, but

to attest to a fact which, by an ingenious expedient adopted at the suggestion of Mr. Amory, is made obvious to the vision of any one who will take the trouble to inspect it; and which appears to be at variance with the statements above quoted. On visiting the shop at the Navy Yard, we found the steam engine which drives the works of the shop in regular operation, the furnaces being constructed on the principle of Baker's patent, with two inverted arches, as illustrated in the cut which accompanies Mr. Isherwood's statement.

For the purpose of exhibiting to view the effect produced on the movement of the flame in its passage from the fire grate through the arches beneath the boiler to the chimney, three square apertures of about 4 ins. in width, were made in one of the side walls of the furnace; one opposite to the centre of each of the arches, and one opposite to the narrow part of the furnace or flue, about three inches in height, where it passes over the sloping wall which separates the two arches. These apertures in the brick work were closed with glass, through which the movement of the flame in the furnace, at any time when it is in action, may be distinctly observed. We observed it during the regular working of the engine, the fire being fed by anthracite coal, the fire place being closed against the admission of air, except what was introduced from without by means of two iron pipes passing through the brick work at the bottom of the inverted arch nearest to the fire place, and so near its inner surface that the air so introduced must be considerably heated in its passage.

On looking through the aperture which opens upon that part of the flue between the two reversed arches, where the passage is narrowed to a height of three inches between the top of the brick work and the bottom of the boiler, a bright flame is seen to pass with a rapidity indicating a strong draft, and with the appearance of being driven horizontally by a strong gale of wind. On looking through the aperture opening to the centre of the arch nearest to the fire place, the flame is of nearly an equal brightness, but has a disturbed motion similar to the agitation of water precipitated over a dam and driven upward by its concussion with the rocks below. It seems to be a movement adapted to produce the effect described in Mr. Baker's specification of "revolving and retaining the volatile products underneath the boiler," and at the same time bringing the surface of the flame, in which the greatest degree of heat is concentrated, into immediate contact with the boiler.

On observing, by means of the third aperture, the appearance of the flame in its passage through the next inverted arch, it was found much diminished in brightness, but passing through with a disturbed and agitated movement, similar to that presented in the first arch. On throwing upon the fire grate, by way of experiment, some light wood kindlings, the brightness of the flame in this arch was very sensibly increased. From the manifest difference thus observed between the motion of the flame and the gases combined therewith, in its passage through the inverted arches, and in its passage from one arch to the other, we cannot doubt that Mr. Isherwood is mistaken in supposing that the heated gases, instead of being revolved and returned, as described in the patent, "will follow in a straight line, taking the shortest and most direct route from furnace to chimney." That the effect of the reversed arches is to pro-

duce the reverberating motion and mixing of the gases described in the patent, and consequently a more thorough combustion, appears to us manifest, from the inspection which we have here described.

NATHAN HALL,
E. H. DERBY,
THOMAS A. DEXTER.

Boston, November 17th, 1854.

Translated for the Journal of the Franklin Institute.

A New Mode of Building Ships.

M. Lombo-Miraval called the attention of the *Society for the Encouragement of National Industry* to a mode of building vessels, which is entirely original. The boats, in this system, are entirely built of iron wire and hydraulic cement, and the author attributes to them the following advantages: great strength, absolute impermeability, quick repair in case of damage, perfect stability obtained by the ballast being at the bottom and making part of the hull; finally, incomparable quickness of building. A vessel built on this system six years ago, has been running ever since, without requiring any repairs, although it has gone through rough trials. Nothing easier, says M. Miraval, than to build in a few days, on board a fleet, as many gun-boats, or rafts for disembarkation, as may be wanted.

Cosmos, vol. v., p. 292.

Translated for the Journal of the Franklin Institute.

New System of Gas-Burners.

M. Ador has at length succeeded in applying his system of gas-lighting on the largest possible scale. In the immense *Café Estaminet de Paris*, he has established a great number of apparatus, furnishing together nearly six hundred candle-burners. The Ador apparatus consists essentially of a tube on which are screwed two bulbs, the one above, which is surrounded by the flame and into which the gas passes from the meter, the other below, supplied by any hydro-carbon (liquid), the surface of which the heated gas licks, and then passes out by small tubes arranged at the summit of this second ball. By this arrangement, the gas is under conditions very different from those in which ordinary burners place it. For, first, the rise of temperature which it undergoes dilates it, causes it to occupy a greater volume, and consequently brings it into contact with a greater quantity of air; the combustion is thus more perfect, and there is no longer any smoke. And, secondly, the contact with the warm hydro-carbon supersaturates the gas with carbon, or solid particles in a state of extraordinary division, and increases in a considerable proportion the brilliancy of the flame, a brilliancy proportioned to the number of solid particles in ignition. This last effect is so certain and so excellent, that when applied to pure hydrogen extracted from water, a gas which in burning gives out a great deal of heat but scarcely any light, it transforms it into an excellent lighting gas. The final result of the two modifications which common gas thus undergoes, is an economy of at least fifty

per cent.; in fact, it is established by numerous and positive experiments, that the elevation of temperature alone diminishes by one-third the quantity of gas consumed for equal light, and the effect of carburation is almost equally great.—*Cosmos,* vol. v., p. 257.

Translated for the Journal of the Franklin Institute.

New Process for Engraving on Zinc.

M. Dumont, an engraver, (*Rue Dauphine,* 17,) describes, under the name of *Zincography,* a process for electric engraving, which is promising. Upon a thick plate of zinc planed and grained with a steel tool and fine sand, he draws any subject with a kind of lithographic crayon; upon the design, when finished, he sprinkles a fine powder, mixed with resin, Burgundy pitch, and bitumen of Judea; by heating the zinc plate he melts this powder, which is converted into a varnish, and spreads over the parts of the surface which have been covered with the fat crayon, that is, on every thing which constitutes the design. To bite in the plate, and obtain the design in relief, he plunges it, while in connexion with the positive pole of the pile, into a bath of sulphate of zinc, in face of another plate connected with the negative pole; the current passes and corrodes the zinc which is not covered by the ink, and thus the design is brought out; from the plate thus engraved in relief, a gutta-percha mould is taken, in which copper is deposited to obtain the engraved plate, from which proofs may be taken by the ordinary typographic press. The process invented by M. Dumont is a new application of the principle first applied by M. Beuviére, and which M. Baldus has successfully used in his attempts at photographic engraving.—*Cosmos,* vol. v., p. 292.

For the Journal of the Franklin Institute.

Leakage of Gas-Pipes.

Will our gas-fitters believe the statement of the Abbè Moigno, that an ingenious Parisian, M. Maccaud, has *at length* found a practical method of detecting the locality of a leak in a gas-tube, which is to stop up all its known openings and pump air into it, and look or listen where it comes out. Yet this immense improvement is announced in *Cosmos* with a terrible flourish of trumpets, and we are told that "the old method was long, ineffectual, and *dangerous from the explosions which it frequently caused.* Happy Paris!

Translated for the Journal of the Franklin Institute.

New Process for Paper Making.

An excellent process for making pulp for paper and pasteboard, from wood, was invented a short time ago by M. Hartmann; this process has been perfected by M. Schlesinger, who has established a manufactury in England, where his methods have great success.

The apparatus which he uses, is composed essentially of a very strong frame of wood or cast iron, presenting an arrangement similar to that of the boxes or troughs of the grindstones used in work-shops, with the difference that the trough is circular only on one side, at its lower part, the other side being rectangular, with an opening in the angle for the drainage of the water and pulp which falls into a reservoir below, as it is produced. A mill-stone, well roughened upon its circumference, is placed on a horizontal axis resting upon two journals placed one at each side of the trough; a rotary motion is given to the axis in any of the ordinary ways, and the wheel turns like a common grind-stone.

The blocks of wood, after being cut of the proper dimensions, are placed in boxes and pressed by rods worked by counter-weights, perpendicularly to the mill-stone, so that the blocks are always in contact with the stone which tears the fibre, and in such a way that their fibres are always parallel to the circumference of the mill-stone. By this means, a pulp is obtained which is equal to the ordinary rag pulp, and cheaper. But this pulp has the property of absorbing a greater quantity of mineral substances, without lessening the strength of the paper. The pulp from hard or soft wood may be stained, and will take the most delicate tints, as well as the paste from rags.

According to the calculation of M. Schlesinger, he can produce a killogramme of *dry* pulp from wood for 10 centimes, (about $ 1·00 per cwt.,) and he does not doubt that in countries where wood and motive power are cheaper, he can prepare it for 7 or 8 cent. per kilog. The cheapest woods, such as the fir, pine, poplar, willow, &c., answer best for this purpose. According to the experiments made, the following articles may be advantageously made: 1st, Packing paper of the first quality, with a mixture of 70 or 80 per cent. of the wood pulp, and 20 or 30 per cent. of rags. 2d, Common wrapping paper, with 50 per cent. of wood pulp. 3d, Writing paper, from the common to the first qualities, with from 40 to 60 per cent. 4th, Wall-paper, with from 80 to 100 per cent. 5th, Card paper, 20 per cent of the wood pulp; this material is the best for making the joints of steam pipes, when it is all of the wood pulp. 6th, Printing paper for Journals, which will stand the highest temperature, from 60 to 75 per cent. 7th, Pasteboard of superior quality with 60 per cent., the quality diminishing to 100 per cent. A quality made with 75 per cent., and 25 of the rag pulp, was tried for cards for the jacquard loom, and resisted the tests of heat and dampness. —L. D'AUBREVILLE, *Cosmos*, vol. v., p. 295.

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*London Smoke. Its Use to Purify the Air.**

Justice demands that the good qualities of smoke should now be shown. In an artistic view of it, smoke is undoubtedly a great evil, because it blackens our buildings, and casts shadows upon them where there should be light; nevertheless, smoke is not an unmitigated evil; in a sanitory or chemical point of view it is very beneficial, for it purifies the air when contaminated with the poisons of malaria. Smoke, in truth, is nothing

* From the London Mining Journal, No. 995.

more than minute flakes of carbon or charcoal. Carbon in this state is like so many atoms of sponge, ready to absorb any of the life-destroying gases with which it may come in contact. In all the busy haunts of men, or wherever men congregate together, the surrounding air is, to a certain extent, rendered pernicious by their excretions, from which invisible gaseous matter arises, such as phosphuretted and sulphuretted hydrogen, cyanogen, and ammoniacal compounds, well known by their intolerable odor. Now, the blacks of smoke (that is the carbon) absorb and retain these matters to a wonderful extent. Every hundred weight of smoke probably absorbs 20 cwts. of the poisonous gases emanating from the sewers and from the various works where animal substances are under manipulation—by fellmongers, for instance, fat-melters, bone-crushers, glue-makers, Prussian-blue makers, &c. This accounts for the fact that London, although the most smoky, is yet the healthiest metropolis in the world. In waging war, therefore, against smoke, as an artistic evil, it is not wholly wise to dispense with it, on account of its sanitory value. Before we try to throw off the cloud-cap of London, we should shut off the sewers from all upward communication with the streets, and by an Act of Parliament send the bone-crushers to Salisbury Plain. As London is at present constituted, smoke is the very safeguard of the health of the population; it is unquestionably the mechanical purifier of a chemically-deteriorated atmosphere.—SEPTIMUS PIESSE: *Chapel-street, Edgeware-road.*

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*New Discovery in Photography.**

One of the most promising improvements which have recently been made in the practice of photography, relates to the collodion process. A surface of collodion is well known to be much more sensitive than that of paper; but the rapidity of evaporation from it rendered it necessary to prepare it immediately before using, and thus in many cases, this process was inapplicable. For the same reason, it could not be used in those cases where the feebleness of the light required a long exposure. By the addition of nitrate of zinc, or of some other diliquescent salt, to the bath, this difficulty may be got over; for the collodion can thus be made to retain a moist surface, and therefore its insensibility for several days. Messrs. Spiuer & Crookes, who have been working out this process, recommend the following mode of dealing with the collodion plate, as having been perfectly successful in their hands:—The plate, coated with collodion, containing iodide, bromide, and chloride of ammonium, in nearly equal proportions, is made sensitive by immersion in a solution of nitrate of silver, 30 grains to the fluid ounce, and then it is transferred to a bath composed of 2 ounces of nitrate of zinc (fused), and 35 grains of nitrate of silver dissolved in six ounces of water. In about five minutes, the salt of zinc will have thoroughly penetrated the film; the plate must then be taken out, and placed upright for about half an hour on blotting paper to drain. When all the moist surface has been absorbed, it may be put aside until required for use. After exposure in the camera,

* From the London Practical Mechanics' Journal, August, 1854.

the development of the plate may be postponed, if desirable, for some days; but previous to development, the plate should be placed for a few seconds in the first-mentioned solution of nitrate of silver. Pyrogallic acid, or a protosalt of iron, may be used in the developing process.

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*Gas Tar in Horticulture.**

A discovery, which is likely to be of great advantage to agriculture, has just been reported to the Agricultural Society at Clermont (Oise). A gardener, whose frames and hot-houses required painting, decided on making them black, as likely to attract the heat better, and from a principle of economy he made use of gas tar instead of black paint. The work was performed during the winter, and on the approach of spring, the gardener was surprised to find that all the spiders and insects which usually infested his hot-house, had disappeared, and also that a vine, which for the last two years had so fallen off that he had intended to replace it by another, had acquired fresh force and vigor, and gave every sign of producing a large crop of grapes. He afterwards used the same substance to the posts and trellis works which supported the trees in the open air, and met with the same result, all the caterpillars and other insects completely disappearing. It is said that similar experiments have been made in some of the vineyards of the Gironde, with similar results. —*Galignani's Messenger.*

Translated for the Journal of the Franklin Institute.

Perfect Preservation of Milk. Method of M. Mabru.

The method of M. Mabru, by which milk is preserved without withdrawing from it any of its essential elements, without reduction of volume, addition of any foreign element, or coloration, consists in withdrawing from it the dissolved gases, air, oxygen, and carbonic acid, by raising its temperature, not in contact with air, as in Appert's process, but in an atmosphere of the vapor of water, then inclosing it in a vessel entirely full of it, out of contact of any gas. M. Mabru, in his present establishment, operates upon six quarts of milk at once; he places the milk in four long tinned or enamelled iron bottles, terminated by lead tubes, about four inches in length. He inserts the leaden necks of the bottles into a prismatic box, and fixes them firmly by screws. He establishes this box, and the bottles hanging from it, above a chamber with metallic walls communicating with a steam boiler; by means of a funnel he pours milk into the box until it covers the mouths of the bottles a half inch or more; he then closes the box and the chamber, heats the boiler until the tube is filled with steam at 212° Fahr., and thus raises the temperature of the milk in an atmosphere of steam. He continues thus to heat from three-quarters of an hour to an hour; he then removes the box with its bottles, and cools them in a vessel of cold water while the layer of milk still covers the mouths of the tubes; when they are cold, he removes each

* From the London Farmer's Magazine, October, 1854.

bottle, flattens the mouth of the lead tube with a pair of strong pincers, and thus closes, hermetically the bottles, filled with milk and devoid of gas. They may then be sent any distance, and in any way, without danger from internal shaking, without any possibility of forming butter, and, at least in the majority of cases, without any danger of alteration. Only the cream gradually separates, rises to the top, and thickens in the lead tube, remaining, however, perfectly pure.—*Cosmos*, vol. v., p. 325.

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*Turkish Recipes for Hydraulic Mortar and Cement.**

As the aqueducts of Constantinople are attracting additional notice the more they are studied and examined, being astonishing works (especially if we take into account the infant state of chemical and manufactorial science of the Turks,) the following recipes will be found of interest, and deserving of examination and trial. It is, moreover, a curious fact, that other semi-barbarous nations, also, are in the possession of mechanical procedures and contrivances, inaccessible even to European science and art; as, for instance, the art of the Chinese to unite (solder) cast iron, &c.

Lime Mortar.—It is prepared with fresh water, and mixed with two parts of powdered lime (*Staub Kalk*) and one part of river sand.

Hydraulic Mortar.—Bricks are pounded until the grains attain the size of common river sand, and one part of the brick powder is mixed with two parts of powdered lime, and the necessary quantity of fresh water. In using this mortar a layer of mortar is placed between the bricks or courses of bricks, of the *same* thickness as the brick, which must have been previously soaked in water; the latter is not to be neglected.

Hydraulic Cement, for the internal dressing (*Putz*) of arched aqueducts, cisterns, baths, and generally all constructions through which water flows or is kept in. Take 100 *ocka* (of $2\frac{1}{4}$ lbs., of 16 ounces,) of fluid lime, and 4 *kilots* (at 22 *ockas*) and 2 *ockas* of very minutely-plucked tow (*werg*,) which is to be distributed very accurately throughout the mass. If these two ingredients have been duly mixed and worked up, the mass thus obtained has to remain quiet during at least eight days, that the tow may have time to combine thoroughly with the lime. If the mortar is to be used, it is again to be well stirred up, and is to be spread with a small trowel; and after this first operation has been performed, the dressing (*Putz*) is yet to be rubbed gently but repeatedly with the trowel, until the surface is quite smooth and plain. For the sake of protecting it still more from the action of the water, and to make it durable for a long time, it is then to be coated by a putty (*Oelkitt*,) which is called *lukin*, and is thus prepared. To 100 *ocka* of freshly burnt lime, which has become converted into dust, 25 *ockas* of the best linseed oil are added, as well as 20 drachms (1 *ocka* $= 2\frac{1}{2}$ lbs. $=400$ drachms) of rough cotton. The lime is to be worked and mixed in a wooden chest or trough, while the linseed oil and the cotton are added in succession, until the mass has obtained the consistency of dough. This mass is preserved, making of it large pieces resembling loaves of bread. If it is to be used, it is stirred

* From the London Mechanic's Magazine, October, 1854.

up with linseed oil, until it becomes fluid, and fit to make a coating, which is painted over twice or thrice. In employing it for lead water-pipes, it is thus used. The lead pipes are made of a length of 0·65 *m*, and first cemented in the whole length, only at the other end, 0·16 *m*, is left free for being able to unite them. If two of these pipes are to be united, one of the ends of the pipes is cut perpendicularly into several pieces with a hand-saw, and they are bound around in the shape of a funnel. We then take some well combed long threaded hemp, soak it with lukium, and cover with it the end of the pipe, A, which is to be united to the pipe, B, in such a way that the hemp bundles (*Hanfstrange*) lie close to each other; but, at the same time, these envelopings are to be so arranged that only one-half of the length of these hemp skeins has been employed. The end of the pipe, A, thus prepared, is then placed in the funnel-shaped end of the pipe, B; and the cut asunder portion of the pipe end, B, is then to be compressed by the remaining portion of the hemp. This envelope, as it were, of hemp is then tied over with a string of about 3 lines diameter, in such a way that the threads lie close to each other. If these cements have become dry, they acquire the hardness of stone, resist all moisture, and possess an indestructible durability. If the pipes lie in an ascending position, two such cementations are to be made, for obtaining an adequate resistance; for those lying in the ground, one is sufficient. The pipes thus united are placed in small drains, supported at intervals, for avoiding this bending, and surrounded by mortar mixed with brick-dust. If the pipes treated in that way have a large diameter, the whole is to be well dried before the water is let in, a precaution unnecessary with small pipes.

Translated for the Journal of the Franklin Institute.

Analysis of Milk.

M. le Docteur Leconte, Adjunct Professor in the Faculty of Medicine, proposes a new process for the analysis of milk, founded upon the determination of the quantity of butter which it contains. As it is proved that the other elements of milk, the sugar and the albumen, obey the same fluctuations as the butter, M. Leconte thought that it would be sufficient to determine this latter element.

His apparatus consists of a tube closed at one end, of about $\frac{8}{10}$th inch in diameter, and divided into five parts, each having a capacity of two cubic inches; to the upper part is attached another of much smaller diameter, and divided into twentieths of a cubic centimetre; finally, at the upper part of this latter tube is another like the lower, but much shorter, and without divisions; this serves as a funnel and receives the liquids which dilate during the operation.

When we wish to make an analysis, two cubic inches (of milk) are measured into the lower tube, and eight cub. inches of crystallizable acetic acid are added; then, after closing the upper orifice of the tube with a glass disk or stopper, the apparatus is shaken for some minutes; the caseine, at first coagulated by the acid, gradually re-dissolves, and the butter rapidly rises to the top in white flakes; it is enough, then, to

heat with an alcohol lamp to melt the butter which forms a liquid stratum, the volume of which is easily measured by the divisions of the smaller tube in which it lies.—*Cosmos*, vol. v., p. 395.

For the Journal of the Franklin Institute.

Particulars and Performance of the Steamer North Carolina. By J. Vaughan Merrick.

Philadelphia.—Hull built by Vaughn & Fisher; Machinery by Merrick & Sons; Owner, Alexander Heron, Jr. Intended Service, Philadelphia to Wilmington, North Carolina.

Hull.—Single decked, with poop cabin.		
Length for tonnage,		172 feet.
Length on deck,		176 "
" deep load water line,		170 "
Greatest breadth at deep load line,		33 " 4 inches.
" " main wales,		32 " 2 "
Depth of hold,		12 " 4 "
Length of engine and boiler space,		34 "
Draft of water at deep load line,		10 "
Tonnage, custom house,	672	
Area of immersed section at 9 ft. 3 ins. mean draft,		249 square feet.
Contents of bunkers in tons of coal,	90	
Masts and rig—Three masts; foremast square rigged; heavily sparred and canvassed.		
Engine.—One—Vertical square.		
Diameter of cylinder,		56 inches.
Length of stroke.		4 feet.
Maximum pressure of steam in pounds.	25	
Cut-off,	Variable from $\frac{1}{3}$ to $\frac{3}{4}$.	
Maximum revolutions per minute,	29 to 30 of engine.	
Gearing,	1 to $2\frac{2}{3}$, giving $77\frac{1}{3}$ to 80 of propeller.	
Boilers.—Two—Return tubular.		
Length of boilers,		13 feet 3 inches.
Breadth "		9 " 7 "
Height " exclusive of steam drum,		10 "
Height " inclusive " "		19 "
Number of furnaces, in all,	8	
Breadth of furnaces,		1 " 9 "
Length of grate bars,		7 " 3 "
Number of flues or tubes, in all,	324	
Internal diameter of flues or tubes,		3 "
Length of flues or tubes,		8 " 3 "
Heating surface, in all,	3010 square feet.	
Diameter of smoke pipe,		4 " 11 "
Height, " "	54 feet above grate.	
Description of coal,	Anthracite.	
Draft,	Natural.	
Consumption of coal per hour,	1500 lbs., estimated.	
Propeller.—True screw, of cast iron.		
Diameter,		9 feet 3 inches.
Length,		2 " 9 "
Pitch,		16 " 6 "
Number of blades,	3	

Remarks.—This ship possesses the largest freighting capacity of any steamship of her tonnage in the U. S. Marine. She was modelled by Mr.

John W. Griffiths, Marine Architect, and was intended for a freight ship with very light draft. With 350 tons dead weight, in addition to her coal for six days' steaming, she will draw but 10 feet on an even keel.

The fore body rises from midship section, so that her real draft from base line, measured on the forward, perpendicular, is three feet less than by marks. She has full after-water lines and amidship section aft of the centre of length.

The engine is a vertical square condensing engine, having its cross-head overhead, and two side rods attached to crank pins in the driving spur wheels, the crank shaft being beneath the cylinder bottom. On the opposite side of the propeller shaft is a tubular condenser; the main and fresh water air pumps and other pumps, are outside of it, worked by boiler plate side levers attached by links to the cylinder cross-head. The valves are equilibrium poppets, with Allen & Wells' adjustable cut-off on steam side. The gearing is of iron, with shrouding to the pitch line; wheels, 6 ft. 4 ins. diameter, and 2 ft. $8\frac{1}{2}$ inches diameter of pinion; 10 ins. face of teeth on each set.

On the trial trip, the propeller was not nearly submerged, being 1 ft. 7 inches out of water; draft aft, 8 ft. 2 ins.; draft forward, 7 ft. 7 ins. Bunkers filled, but no freight in. The boilers made abundance of steam for 29 revolutions of the engine, while indicator cards showed an initial pressure in the cylinder of 25 to 26 lbs., cut-off at three feet, or $\frac{3}{4}$ stroke.

On the first trip of the ship, her performance down the river, as far as Newcastle, was noted, and is given below; owing to the floating ice in the river, the ship was not driven, a pressure of 21 pounds only being maintained in the boilers, cut-off at 18 inches, or $\frac{3}{8}$ths of the stroke only. From the speed then attained, (10 miles per hour,) it is probable that at least $11\frac{1}{2}$ miles per hour may be obtained with full *steam pressure*, in still water.

Performance on First Trip.—Draft of water aft, 10 feet; forward, 8 feet 6 inches; with 150 tons freight, beside 90 tons of coal in the bunks.

Passed	Time.		Whole distance.		Registered revolutions.		Revs. per mile.		Steam.	Vacuum.	Cut-off in Ins.
	H's.	Running.	Apparent.	Actual.	Whole.	Nett	Engine	Propeller.			
Navy Yard,	10·20				477				14		18
Chester,	12·	1·40	16·50	17·00	2870	2393	140·8	375·4	20	$26\frac{1}{2}$	18
Marcus Hook,	12·55				3853				21		18
Newcastle,	2·45	1·50	14·50	18·50	6600	2747	152·5	406·7	21	$26\frac{1}{2}$	18
Means,							146·6	391·5			

The actual distance is known by applying a correction for tide, which was adverse except for about four miles.

The particulars from Chester to Marcus Hook are not noted, owing to time, &c., lost in landing a passenger.

The average revolutions per mile run by the ship, were $391\frac{1}{2}$ of the propeller, equal to its advance through $391\frac{1}{2} \times 16\frac{1}{2} = 6459$ feet.

The slip was, therefore, $6459 - 5280 = 1179$ feet $= 18\frac{1}{4}$ per cent. The average revolutions per minute, with 19 pounds steam, cutting off

at $\frac{5}{8}$ths stroke, from Navy Yard to Chester, were 23·93; and with 21 lbs. at $\frac{5}{8}$-ths stroke, from Marcus Hook to Newcastle, were 24·88.

The propeller shaft has a slip clutch, by which the propeller may be disengaged when the ship is under sail.

The engineer's department of this ship is provided with every convenience. A Worthington steam pump is attached for putting out fires, washing decks, pumping bilge, or feeding boilers; it has an auxiliary steam boiler on deck by which it may be worked in port. The thrust bearing of the shaft has Parry's anti-friction conical rollers, which worked well so far as heard from.

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*On an Improved Construction of Moulds for Casting Metals.**

The subject of this paper is the invention of Mr. John Jobson, of Derby, and may perhaps be considered as one of the results of the difficulty experienced in the labor market. This invention consists of a mode of constructing the moulds for metal castings, by means of which the process of moulding is simplified, and an important economy effected in the cost and time of moulding; also the accuracy and perfection of the moulds is increased, so that the castings produced have less "fin" or other irregularities than usual, and greater uniformity is insured in running the metal, than in the ordinary method of moulding, reducing the proportion of "wasters."

The advantages of the new plan are most felt in the cases where a large number of castings have to be made from the same pattern; also where the more intricate form of the pattern (as in foliage or ornamental castings) makes it difficult to draw from the sand in the ordinary process of moulding, and the irregular surface of the "parting" or separation between the moulds increases the difficulty of making a clean casting, free from "fin," and also involving considerable time and skilful labor, which has to be repeated for every casting.

In the new process of moulding (the subject of the present paper,) after the pattern has been first partially imbedded in the sand of the bottom box (as in ordinary moulding,) and the parting surface accurately formed, the top box is then placed on, and is filled with plaster of Paris, or other similar material, to which the pattern itself adheres. When the plaster is set, the boxes are turned over, the sand is carefully taken out of the bottom box, and a similar process repeated with it,—using claywash to prevent the two plaster surfaces from adhering. This forms a corresponding plaster mould of lower portion of the pattern. These two plaster moulds may be called the "waste blocks," as they are not used in producing the moulds for casting, but are subsequently destroyed.

Reversed moulds, in plaster, are now made from these waste blocks (the pattern being first removed,) by placing upon the bottom box a second top box, an exact duplicate of the former top box, and filling it up with plaster (having used clay-wash as before,) and doing the same with the other box. Reversed moulds are thus obtained, from which the final sand moulds for casting are made, by using them as "ramming-blocks,"

* From Lond. Journ. and Rep. Sci., Nov., 1854.

upon which the sand forming the mould is rammed, by placing a third duplicate top box upon the ramming-block, and a corresponding bottom box upon the ramming-block.

The requisite "gits," "runners," and "risers," are formed previously in the original sand mould, and are consequently represented in the ramming-blocks by corresponding projections or ribs upon the parting face of the one, and hollows in the other, (which are then stopped up with plaster,) and these are properly repeated in the final sand moulds; these last, therefore, when put together, form a complete mould for casting, just like an ordinary sand mould, but having some important advantages.

Any number of succeeding moulds can be made from the original ramming-blocks by the simple process of ramming, without any handling of the pattern or turning over the boxes; both top and bottom moulds being rammed independently, and at the same time, if desired. The parting being once accurately formed in the original mould, all the succeeding ones are necessarily correct, without any further care being required; and by carefully trimming the original, and slightly paring down the inner edges of the parting faces, if requisite, the faces of the final sand moulds have a corresponding fulness, and are readily adjusted, after the first trial, to fit so closely together, that practically no fin is left on the castings, as shown by the specimens before the meeting, which are all of them just in the state in which they left the sand, never having been dressed or trimmed. Also, the labor of forming the gits and runners afresh for each casting mould is avoided, by having them completely imprinted upon each mould in the process of ramming; and by this means all the risk is avoided of imperfect castings arising from want of uniform care or judgment in the formation of the gits, &c., by the moulder in the ordinary process. This is the more important in the case of difficult castings, where several trials may be required before the best mode of running the metal is ascertained, so as to insure sound, good castings; and by this process the exact repetition of the same plan is insured, without requiring any further attention from the moulder.

A small hollow is imprinted in the ramming-block for the top box, into which the plug for forming the git is rested whilst the box is rammed; and by this means the git is insured being formed in the right place, without any care on the part of the moulder.

When the pattern is long and very thin and intricate (as in the case of an ornamental fender front,) where the general surface is also curved or winding, the difficulty of picking out the pattern from the mould is so great as to require the most skilful workman; and the length of time required for repairing the injuries of the mould, causes about eight sets of fender castings per day to be the general limit to the number that can be moulded by one man and a boy. But however difficult the pattern may be to mould in the ordinary way (if it is arranged to "draw" properly from the mould,) with the new process the labor is very little greater than with an easy pattern, and the saving of time is so great that as many as 30 per day are moulded on the average by one laborer and boy.

When the pattern is slender and long, it is liable to be broken in the frequent handling to which it is subjected in the ordinary process of moulding, and the expense and delay caused by breakage of patterns is

of serious consequence in light ornamental work; but in the new plan this is entirely avoided, as the pattern is never handled except in the first process of moulding, to form the ramming-blocks.

When the face of the castings is required to be particularly well finished (as in the case of ornamental work) a brass or other metal pattern is made, and is dressed up and finished to the degree that may be desired in the castings, and any chasing or other additional ornament put upon it; then, after forming the ramming-block for the bottom box by a plaster cast from the pattern, in the manner before described, the pattern itself is made to form the permanent face of the ramming-block for the top box, by leaving it in the mould when the plaster is poured in; so that the plaster forms merely the parting face, and a solid back to the pattern. In this case the iron pattern is secured to the cross bars of the box by several small bolts screwed up to plates at the back of the box; so that, when the plaster is poured in, filling up the whole vacant space of the box, and setting solid around these bolts and over these nuts, the iron pattern becomes so firmly secured in the box, that no ramming or moving to which it is afterwards subjected will loosen it.

In this plan the mould for the face of every casting is formed from the original metal pattern, and the pattern itself is firmly and permanently secured in the plaster bed; so that, however thin and delicate it may be, there is no risk of injury to the pattern, in moulding any number of castings;—as many as 3000 have been cast without injury from a slender ornamental pattern.

In forming the ramming-blocks, common plaster of Paris is generally employed, as the most convenient and economical material; and this is found to be sufficiently durable for general work. The blows of the rammer are deadened by the sand in the box, and do not fall directly upon the plaster block,—so that there is no risk of injury with ordinary care in ramming. As many as 4000 castings have been moulded from one pair of plaster blocks; but when a greater number of castings is required from one pattern, or when the size or nature of the mould renders a harder face advisable, a metal face is employed for the ramming-block of the bottom box, or for the parting surface of one or both blocks. This is formed simply by running into the mould, when prepared for the plaster, a small portion of metal, consisting of zinc, hardened with about $\frac{1}{15}$th part of tin; sufficient metal being used to form a strong plate for the surface of the ramming-block, and the rest of the space at the back filled with plaster as usual. In practice it is more convenient generally to reverse the mode of running this metal for the face of the mould, by first ramming the box, when prepared for the plaster, full of sand, then lifting it off, and paring off the surface of the sand wherever the metal is wanted to such depth (about $\frac{3}{8}$ of an inch) as may be desired for the metal; and when the box is replaced in its former position, the metal is run in, filling up those spaces where the sand has been cut away. The sand in the upper box at the back of the metal face is then all removed, without moving the box (part at a time if requisite), and plaster poured in above to fill up the box and make a solid back as before.

The metal face is firmly secured to the plaster back by several small dovetail blocks cast upon the back of the metal, by cutting out corres-

ponding holes in the sand mould before the metal is run in. Variou- modifications of this plan of construction are employed, according to cirs cumstances, for economy or convenience; and sometimes the face of the ramming-block is partially covered by separate pieces of metal; but, in every case, the entire face of the two ramming-blocks forms a perfect counterpart of the intended casting (half being represented upon each,) surrounded by parting faces which exactly fit one another, because the one has been moulded from the other.

Where the pattern is long, and a metal face is employed, a narrow division is made, subdividing the metal face into two or more lengths, to allow for the shrinking of the metal forming the face,—the effect of which is then found to be imperceptible. The plaster ramming-blocks are varnished when dried, to preserve them from damp; and, in moulding from them, the faces of the blocks are dusted with rosin, to prevent adhesion of the sand.

The new process of producing the blocks, though somewhat complicated in description, involves practically but little increase of work over the process of moulding required for the first casting produced by the ordinary method; but every subsequent casting, instead of requiring a repetition of the whole process of the first moulding, as in the ordinary method, is moulded by simply ramming the boxes upon their respective blocks. The ordinary "odd side" boxes are used for this purpose,—all that is requisite being that every top box fits steadily and securely upon every bottom box, so that they may be interchanged in the process of forming the ramming-blocks, without disturbance of the relative position of the pattern. An improved form of the steady pins for connecting the top and bottom boxes has been adopted. Instead of four or more round pins fixed on the bottom box, and fitting into corresponding holes in lugs cast upon the top box, vertical angular studs are cast on each bottom box, and fit against corresponding projections on the edge of the top box. The only fitting required in making the boxes is to file the touching angles of the pins, so as to fit one standard top box; the projections on the top boxes being all fitted to one standard bottom box.

It has to be noticed, that in the ordinary plan of moulding, and by the "odd side" and "plate" methods, one side of a pattern is not available while the other is in use. By the new process, each pattern is equal to two, as it will be evident that both blocks may be worked from at the same time.

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Mr. Jobson exhibited a number of specimens of castings rough from the mould, to show the unusually small amount of fin upon them, and the good quality of the castings obtained by the new process of moulding. Also several of the plaster ramming-blocks were exhibited of the different kinds, and a pair shown in operation, showing the quickness of the process of moulding from them, and the perfection of the sand moulds obtained.

The Chairman thought the process was certainly very efficient in insuring expedition and accuracy, and the moulding was remarkably perfect; there must be an important economy both in the cost of moulding

and in the cost of dressing the castings, which were turned out remarkably clean and free from fin.

Mr. Jobson said that in the ornamental castings the dressing formerly cost as much as £10 per ton, from the fin left in the old process of moulding; but this expense was now mostly saved, as there was practically no fin left with the new plan. The specimens exhibited showed the ordinary average work produced; and the castings were just in the state in which they left the mould, not having had any trimming or dressing. For particularly fine work a sulphur face was used for the ramming-block instead of plaster; a small thickness of sulphur being first run on to form the face of the block, like the metal facing used in those blocks from which a very large number of moulds was required to be rammed.

In answer to an inquiry, he stated that the largest size of casting at present moulded by the new process was about 3 feet 6 inches square, and 8 ft. by 1 ft. With large castings there was seldom perhaps a case of a sufficient quantity from one pattern, or it might be advantageous to apply the plan.—*Proceedings of the Institution of Mechanical Engineers, Birmingham.*

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*The Boilers of the Arctic.**

Mr. Prosser read a paper on surcharged steam, in which he commented particularly on the construction of the boilers of the *Arctic*, which had just left Liverpool on its last voyage. The main object of the paper was to show that the great source of difficulty and danger in the use of steam is to be found in its high temperature rather than in its high pressure, and that, consequently, all other things being equal, that medium which requires the highest temperature to produce a given pressure is the most difficult and dangerous. In the boilers of the *Arctic* the plan was adopted of giving additional heat to the steam after it was generated, and that plan Mr. Prosser contended is defective in principle and causes a greater consumption of fuel. To accomplish the heating of the steam, a portion of it was passed through wrought iron pipes, which were placed within the furnace of the boilers, and after being heated by coming in contact with it, the steam was reunited with the other portion which had not been so heated, and then passed into the steam chest and cylinder. The tubes of wrought iron, 5 inches in diameter externally, were placed horizontally fore and aft in each furnace, one on each side; the lower ones communicating with the upper ones by other tubes placed vertically of the same diameter, and united by malleable cast iron elbows.

The principle of using heated steam is no novelty, as it had been put in practice by Watt, and abandoned as useless. Numerous other persons had since revived the plan as new, and had endeavored by fallacious experiments to prove its advantages; but Mr. Prosser contended there is loss, and no gain whatever, in heating the steam. He alluded particularly to the experiments and calculations which had led to the determination of introducing the "mixture" of steam and heated steam into the system of the *Arctic*. The experiments and calculations referred to are

* From the Lond. Civil Eng. and Arch. Journ. Nov., 1854.

detailed in the *Journal of the Franklin Institute* for the current year. They were compiled by Mr. Isherwood, from the notes of Mr. Martin. The experiments were intended to prove the advantages of "surcharged" over "normal steam," and of the "mixture" over both when applied to steam engines, whether condensing or not. A very little reflection, however, would show that, if any thing at all is proved, it is the exact contrary to the inferences drawn therefrom. High pressure steam had been limited in its application by a sense of danger, but a far greater one is involved in its high temperature, and in these very experiments it is recorded that the felt covering of the steam pipe was burned.

The *Arctic* had been fitted up with sixteen double furnaces in four boilers. Each double furnace worked into one tube chamber, and had an aggregate recipient heating surface of about 1000 feet through which to transmit about 1000 degrees of heat to the water in the boiler, and thus convert it into steam. The steam heaters in each double furnace exposed about 50 feet to the direct action of the fire, and he had assumed the additional heating surface at 5 per cent. of the whole which the boilers previously had. The average pressure used was about 16 lbs. above the atmosphere. The density of the steam would, therefore, be about $\frac{1}{836}$th as compared with water, and this addition might increase the density, if applied in the ordinary way, by about 5 per cent., the corresponding increase of elasticity to which is 2 lbs., or, in other words, we may calculate upon a gain of about 7 per cent. by a consumption of fuel equal to 5 per cent. only, or four tons per day, taking the ordinary present consumption at 80 tons per 24 hours. It is not, however, proposed to apply the heat thus, but to the heating of the steam. Now, as steam has but about one-quarter the specific heat of water, it follows that the same amount of heat cannot be extracted by the steam, or by water, from the additional surface in the same space of time. Even in the impossible supposition of the density of the steam being the same as water, the rate of absorption can be but one-quarter, or equal to the specific heat of the steam, as compared with water, and requiring, therefore, the combustion of 1 ton instead of 4 tons of coal per day, that being all that the steam will take up. But the density of the steam, if taken only at 1·800 that of water, and half of the whole which is generated is made to pass through the steam heaters, it follows that the velocity must be 400 times greater than would be necessary in the case of water being substituted for the steam to be heated.

Mr. Prosser said he had endeavored to show, first, that these experiments are of no value whatever, because they meet no possible case, and, secondly, that the addition of 5 per cent. of recipient heating surface to a boiler will be far more efficacious when applied in the ordinary way to the evaporation of the water, and consequent increased tension of the steam, than to the heating thereof. The whole operation in either case is merely mechanical, although many have attached to it a mysterious action, a sort of mechanical catalysis, very difficult indeed to understand, and still more so to explain in any rational manner.

The great advantage of using water as the medium consists in its great density as compared with its vapor; and this also, together with the enormous amount of latent heat in its vapor, is a great source of safety, as it

avoids the danger attendant upon a sudden increase of heat, by absorbing it without the production of that fearful state of attenuation of the metal which the repeated overheating of it must inevitably produce, to say nothing of the diminished strength by a slight increase over the usual temperature employed in the steam heaters. Steam is instantly condensed by coming in contact with any thing colder than itself, and hence arises enormous loss and waste, the avoidance of which appears to have led many to the belief that using heated steam is the proper remedy for this great defect. A remedy it certainly is, and one simple enough, but beset with difficulties and dangers which few are aware of, and far exceeding any other known method of using steam, however high-pressure it may be. In conclusion, Mr. Prosser suggested the use of high-pressure steam, worked expansively, and condensed without a vacuum, for ocean steamers. High-pressure steam, he said, is always dry when worked expansively under ordinary circumstances; and when, in addition to that, the working cylinder has a steam jacket, it is more than probable that far greater economy will be attained, without increase of danger, than by any system of "surcharged steam" it is possible to devise —*Proceedings of the British Association for the Advancement of Science.*

On Magneto-Electricity and Under-Ground Wires, as applied for Telegraphic Purposes.

In a paper on the above subject, Mr. Edward Bright said:—Magneto-electricity, as well known, is the current induced in a coil of wire when moved before the poles of a permanent magnet, a positive current being manifested at one end of the coil, and a negative current at the other, upon any movement of the coil before the poles. The greatest development of induced currents occurs when the coil is electro-magnetic (the helix of wire wound upon a soft iron core.)

As applied to telegraphic purposes, the iron core of the coil, when at rest, partly serves as a keeper to the magnet, though not actually in contact with the poles; and when worked by a key attached to the axle, the coil moves freely before the magnet, generating a current with each change of position, which is applied to actuate indicators or ring bells at a distance. This principle constitutes the system of the Magnetic Telegraph Company; all other companies in this kingdom and America have adopted the galvanic battery.

The generating magnets have remained unimpaired in strength during three years of constant use (a period in which a dozen consecutive series of voltaic batteries would have been worn out.)

The magnetic currents thus generated can be passed through subterranean wires, to a distance of 660 miles (the utmost extent of such conductors in England,) without any break or renewal of circuit.

The return (or recoil) current from underground wires, which has interfered with the working of other telegraphs, is applied in the magnetic apparatus to assist in working it; being made to keep the indicating needles at zero until actuated from a distant station.

* From the London Mechanics' Magazine, October, 1854.

A remarkable feature in underground wires is the small comparative velocity with which the electric sensation passes through such conductors. Professor Wheatstone's experiments on a short length of wire in a room have demonstrated that *frictional* electricity passes at nearly 300,000 miles per second; (this variety cannot, however, be practically applied for telegraphic purposes.) Professor Walker's (America) give the speed of galvanic electricity through overground telegraph wires at only 16,000 miles per second; while, lastly, experiments conducted by the engineer of the Magnetic Company and myself, on an underground length of about 500 miles of gutta percha covered copper wire, show that the transmission of galvanic or magnetic currents through such conductors varies from 960 to 1700 miles per second, according to the intensity of the current employed.

This diminution in velocity, as regards the underground wires, is intimately connected with the recoil current recently analyzed by Dr. Faraday, and proved as due to the analogy between such conductors and a Leyden jar, the electricity communicated being temporarily absorbed by the wire until the mass of copper is saturated with electricity; hence retardation ensues.

From the foregoing, I deduce that the speed with which electricity passes varies with the energy (that is, intensity,) of the current employed, and also with the nature or conditions of the conductor interposed through which it passes.

Underground wires are only affected by terrestrial electricity, when a flow takes place from *one district* of the earth's surface to *another;* while *overground* wires are also subjected to the action of perturbative currents whenever the electrical *status* of the atmosphere changes as regards the earth—principally during the rising or falling of the dew—*aurora borealis*, &c.

In the *Quarterly Review* for June, 1854, a very unjust and erroneous comparison is instituted between the English and American scale of charges for telegraphic messages, the American rate being stated to be about one-tenth that of this country.

To correct such a statement, which is calculated seriously to prejudice the English companies with the public, I should mention that considerably prior to the publication of the *Review* the charges in England were considerably lower than in the United States; and that instead of the cost of a message of twenty words between Louisville and Pittsburgh being 20 cents, or 10d., the American charge (as proved by the tariff of the American Telegraph Confederation, published at New York, (in April last,) was 3s. 6d.; while the English rate for a similar message, transmitted an equal distance, was 2s. 6d. And in another case the *Quarterly* states the charge between New York and New Orleans to be 2s. 7d. for ten words, whereas the charge is 10s. The economy of system claimed for America does not exist, but the advantage is on the English side. The lecture was accompanied and illustrated by experiments.

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LIST OF AMERICAN PATENTS, WITH REMARKS, &c.